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GLAUCUS;

OR,

THE WONDERS OF THE SHORE.



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THE WONDERS OF THE SHORE.

BY

CHARLES KINGSLEY.

AUTHOR OF "AMYAS LEIGH," "HYPATIA," ETC.

BOSTON:

TICKNOR AND FIELDS.

M DCCC LV.

PR4842

G53

C A M E R I D G E :

METCALF AND COMPANY, PRINTERS TO THE UNIVERSITY.

DEDICATION.

MY DEAR MISS GRENFELL,

I CANNOT forego the pleasure of dedicating this little book to you; excepting of course the opening exhortation (needless enough in your case) to those who have not yet discovered the value of Natural History. Accept it as a memorial of pleasant hours spent by us already, and as an earnest, I trust, of pleasant hours to be spent hereafter (perhaps, too, beyond this life in the nobler world to come) in examining together the works of our Father in Heaven.

Yours ever gratefully and faithfully,

C. KINGSLEY

BIDEFORD, April 24, 1855.



Beyond the shadow of the ship
I watched the water-snakes :
They moved in tracks of shining white,
And when they reared, the elfin light
Fell off in hoary flakes.

O happy living things ! no tongue
Their beauty might declare :
A spring of love gushed from my heart,
And I blessed them unaware.

COLERIDGE'S *Ancient Mariner*

GLAUCUS;

OR,

THE WONDERS OF THE SHORE.

YOU are going down, perhaps, by railway, to pass your usual six weeks at some watering-place along the coast, and as you roll along think more than once, and that not over cheerfully, of what you shall do when you get there. You are half-tired, half-ashamed, of making one more in the "ignoble army of idlers," who saunter about the cliffs, and sands, and quays; to whom every wharf is but a "wharf of Lethe," by which they rot "dull as the oozy weed." You foreknow your doom by sad experience. A great deal of dressing, a lounge in the club-room, a stare out of the window with the telescope, an attempt to take a bad sketch, a walk up one parade and down another, interminable reading of the silliest

of novels, over which you fall asleep on a bench in the sun, and probably have your umbrella stolen ; a purposeless fine-weather sail in a yacht, accompanied by ineffectual attempts to catch a mackerel, and the consumption of many cigars ; while your boys deafen your ears, and endanger your personal safety, by blazing away at innocent gulls and willocks, who go off to die slowly, a sport which you feel in your heart to be wanton, and cowardly, and cruel, and yet cannot find in your heart to stop, because “the lads have nothing else to do, and at all events it keeps them out of the billiard-room” ; and after all, and worst of all, at night a soulless *rechauffé* of third-rate London frivolity ; this is the life-in-death in which thousands spend the golden weeks of summer, and in which you confess with a sigh that you are going to spend them.

Now I will not be so rude as to apply to you the old hymn-distich about one who

“ Finds some mischief still
For idle hands to do ” :

but does it not seem to you, that there must surely be many a thing worth looking at ear-

nestly, and thinking over earnestly, in a world like this, about the making of the least part whereof God has employed ages and ages, further back than wisdom can guess or imagination picture, and upholds that least part every moment by laws and forces so complex and so wonderful, that science, when it tries to fathom them, can only learn how little it can learn? And does it not seem to you that six weeks' rest, free from the cares of town business, and the whirlwind of town pleasure, could not be better spent than in examining those wonders a little, instead of wandering up and down like the many, still wrapt up each in their little world of vanity and self-interest, unconscious of what and where they really are, as they gaze lazily around at earth and sea and sky, and have

"No speculation in those eyes
Which they do glare withal"?

Why not, then, try to discover a few of the Wonders of the Shore? For wonders there are there around you at every step, stranger than ever opium-eater dreamed, and yet to be seen at no greater expense than a very little time and trouble.

Perhaps you smile in answer, at the notion of becoming a "Naturalist": and yet you cannot deny that there must be a fascination in the study of natural history, though what it is is as yet unknown to you. Your daughters, perhaps, have been seized with the prevailing "Pteridomania," and are collecting and buying ferns, with Ward's cases wherein to keep them, (for which you have to pay,) and wrangling over unpronounceable names of species, (which seem to be different in each new Fern-book that they buy,) till the Pteridomania seems to you somewhat of a bore: and yet you cannot deny that they find an enjoyment in it, and are more active, more cheerful, more self-forgetful over it, than they would have been over novels and gossip, crochet and Berlin-wool. At least you will confess that the abomination of "Fancy work," that standing cloak for dreamy idleness, (not to mention the injury which it does to poor starving needlewomen,) has all but vanished from your drawing-room since the "Lady-ferns" and "Venus's hair" appeared; and that you could not help yourself looking now and then at the said "Venus's hair," and agreeing that nature's real beauties were somewhat superior

to the ghastly woollen caricatures which they had superseded.

You cannot deny, I say, that there is a fascination in this same Natural History. For do not you, the London merchant, recollect how but last summer your douce and portly head-clerk was seized by two keepers in the act of wandering in Epping Forest at dead of night, with a dark lantern, a jar of strange sweet compound, and innumerable pocketsful of pill-boxes; and found it very difficult to make either his captors or you believe that he was neither going to burn wheat-ricks, or poison pheasants, but was simply "sugaring the trees for moths," as a blameless entomologist? And when, in self-justification, he took you to his house in Islington, and showed you the glazed and corked drawers full of delicate insects, which had evidently cost him in the collecting the spare hours of many busy years, and many a pound too, out of his small salary, were you not a little puzzled to make out what spell there could be in those "useless" moths, to draw out of his warm bed, twenty miles down the Eastern Counties Railway, and into the damp forest like a deer-stealer, a sober white-headed Tim Linkinwater like him, your

very best man of business, given to the reading of Scotch political economy, and gifted with peculiarly clear notions on the currency question? .

It is puzzling, truly. I shall 'be very glad if these pages help you somewhat toward solving the puzzle.

We shall agree at least that the study of Natural History has become now-a-days an honorable one. A Cromarty stone-mason is now perhaps the most important man in the city of Edinburgh, by dint of a work on fossil fishes ; and the successful investigator of the minutest animals takes place unquestioned among men of genius, and, like the philosopher of old Greece, is considered, by virtue of his science, fit company for dukes and princes. Nay, the study is now more than honorable ; it is (what to many readers will be a far higher recommendation) even fashionable. Every well-educated person is eager to know something at least of the wonderful organic forms which surround him in every sunbeam and every pebble ; and books of Natural History are finding their way more and more into drawing-rooms and school-rooms, and exciting greater

thirst for a knowledge which, even twenty years ago, was considered superfluous for all but the professional student.

What a change from the temper of two generations since, when the naturalist was looked on as a harmless enthusiast, who went "bug-hunting," simply because he had not spirit to follow a fox! There are those alive who can recollect an amiable man being literally bullied out of the New Forest, because he dared to make a collection (at this moment, we believe, in some unknown abyss of that great Avernus, the British Museum) of fossil shells from those very Hordle Cliffs, for exploring which there is now established a society of subscribers and correspondents. They can remember, too, when, on the first appearance of Bewick's "British Birds," the excellent sportsman who brought it down to the Forest was asked, Why on earth he had bought a book about "cock-sparrows"? and had to justify himself again and again, simply by lending the book to his brother sportsmen, to convince them that there were rather more than a dozen sorts of birds (as they then held) indigenous to Hampshire. But the book, perhaps, which turned the tide in favor of Natural His-

tory, among the higher classes at least, in the South of England, was White's "History of Selbourne." A Hampshire gentleman and sportsman, whom everybody knew, had taken the trouble to write a book about the birds and the weeds in his own parish, and the every-day things which went on under his eyes, and every one else's. And all gentlemen, from the Weald of Kent to the Vale of Blackmore, shrugged their shoulders mysteriously, and said, "Poor fellow!" till they opened the book itself, and discovered to their surprise that it read like any novel. And then came a burst of confused, but honest admiration; from the young squire's "Bless me! who would have thought that there were so many wonderful things to be seen in one's own park!" to the old squire's more morally valuable "Bless me! why I have seen that and that a hundred times, and never thought till now how wonderful they were!"

There were great excuses, though, of old, for the contempt in which the naturalist was held; great excuses for the pitying tone of banter with which the Spectator talks of "the ingenious" Don Saltero (as no doubt the Neapolitan gentlemen talked of Ferrante Imperato the apoth-

ecary, and his museum); great excuses for Voltaire, when he classes the collection of butterflies among the other "bigarrures de l'esprit humain." For, in the last generation, the needs of the world were different. It had no time for butterflies and fossils. While Buonaparte was hovering on the Boulogne coast, the pursuits and the education which were needed were such as would raise up men to fight him; so the coarse, fierce, hard-handed training of our grandfathers came when it was wanted, and did the work which was required of it, else we had not been here now. Let us be thankful that we have had leisure for science; and show now in war that our science has at least not unmanned us.

Moreover, Natural History, if not fifty years ago, certainly a hundred years ago, was hardly worthy of men of practical common sense. After, indeed, Linné, by his invention of generic and specific names, had made classification possible, and by his own enormous labors had shown how much could be done when once a method was established, the science has grown rapidly enough. But before him little or nothing had been put into form definite enough to allure those who (as the many always will)

prefer to profit by others' discoveries, than to discover for themselves ; and Natural History was attractive only to a few earnest seekers, who found too much trouble in disencumbering their own minds of the dreams of bygone generations, (whether facts, like cockatrices, basilisks, and krakens, the breeding of bees out of a dead ox, and of geese from barnacles, or theories, like those of the four elements, the *vis plastrix* in Nature, animal spirits, and the other musty heirlooms of Aristotleism and Neo-Platonism,) to try to make a science popular, which as yet was not even a science at all. Honor to them, nevertheless. Honor to Ray and his illustrious contemporaries in Holland and France. Honor to Seba and Aldrovandus ; to Pomet, with his "Historie of Drugges" ; even to the ingenious Don Saltero, and his tavern-museum in Cheyne Walk. Where all was chaos, every man was useful who could contribute a single spot of organized standing-ground in the shape of a fact or a specimen. But it is a question whether Natural History would have ever attained its present honors, had not Geology arisen, to connect every other branch of Natural History with problems as vast and awful as they are captivat-

ing to the imagination. Nay, the very opposition with which Geology met was of as great benefit to the sister sciences as to itself. For, when questions belonging to the most sacred hereditary beliefs of Christendom were supposed to be affected by the verification of a fossil shell, or the proving that the Maestricht "*homo diluvii testis*" was, after all, a monstrous eft, it became necessary to work upon Conchology, Botany, and Comparative Anatomy, with a care and a reverence, a caution and a severe induction, which had been never before applied to them ; and thus gradually, in the last half-century, the whole choir of cosmical sciences have acquired a soundness, severity, and fulness, which render them, as mere intellectual exercises, as valuable to a manly mind as Mathematics and Metaphysics.

But how very lately have they attained that firm and honorable standing-ground ! It is a question, whether, even twenty years ago, Geology, as it then stood, was worth troubling one's head about, so little had been really proved. And heavy and up-hill was the work, even within the last fifteen years, of those who steadfastly set themselves to the task of proving, and of asserting at all risks, that the Maker of

the coal seam and the diluvial cave could not be a "Deus quidam deceptor," and that the facts which the rocks and the silt revealed were sacred, not to be warped or trifled with for the sake of any cowardly and hasty notion that they contradicted His other messages. When a few more years are past, Buckland and Sedgwick, Lyell and Jamieson, and the group of brave men who accompanied and followed them, will be looked back to as moral benefactors to their race ; and almost as martyrs, also, when it is remembered how much misunderstanding, obloquy, and plausible folly they had to endure from well-meaning fanatics like Fairholme or Granville Penn, and the respectable mob at their heels, who tried (as is the fashion in such cases) to make a hollow compromise between fact and the Bible, by twisting facts just enough to make them fit the fancied meaning of the Bible, and the Bible just enough to make it fit the fancied meaning of the facts. But there were a few who would have no compromise ; who labored on with a noble recklessness, determined to speak the thing which they had seen, and neither more nor less, sure that God could take better care than they of His own ever-

lasting truth; and now they have conquered; the facts which were twenty years ago denounced as contrary to Revelation, are at last accepted not merely as consonant with, but as corroborative thereof; and sound practical geologists, like Hugh Miller, in his "Footprints of the Creator," and Professor Sedgwick, in the invaluable notes to his "Discourse on the Studies of Cambridge," are wielding in defence of Christianity the very science which was faithlessly and cowardly expected to subvert it.

But if you seek, reader, rather for pleasure than for wisdom, you can find it in such studies, pure and undefiled.

Happy, truly, is the naturalist. He has no time for melancholy dreams. The earth becomes to him transparent; everywhere he sees significances, harmonies, laws, chains of cause and effect endlessly interlinked, which draw him out of the narrow sphere of self-interest and self-pleasing, into a pure and wholesome region of solemn joy and wonder. He goes up some Snowdon valley; to him it is a solemn spot (though unnoticed by his companions), where the stag's-horn club-moss ceases to straggle across the turf, and the tufted alpine club-

moss takes its place ; for he is now in a new world ; a region whose climate is eternally influenced by some fresh law (after which he vainly guesses with a sigh at his own ignorance) which renders life impossible to one species, possible to another. And it is a still more solemn thought to him, that it was not always so ; that æons and ages back, that rock which he passed a thousand feet below was fringed, not as now with fern, and blue bugle, and white bramble-flowers, but perhaps with the alp-rose and the “gemsen-kraut” of Mont Blanc, at least with Alpine Saxifrages which have now retreated fifteen hundred feet up the mountain-side, and with the blue Snow-Gentian, and the Canadian Ledum, which have all but vanished out of the British Isles. And what is it which tells him that strange story ? Yon smoothed and rounded surface of rock, polished, remark, across the strata, and against the grain ; and furrowed here and there, as if by iron talons, with long parallel scratches. It was the crawling of a glacier which polished that rock-face ; the stones fallen from Snowdon peak into the half-liquid lake of ice above, which ploughed those furrows. Æons and æons ago, before the time when Adam first

“Embraced his Eve in happy hour,
And every bird of Eden burst
In carol, every bud in flower,”

those marks were there; the records of the “Age of ice”; slight truly; to be effaced by the next farmer who needs to build a wall; but unmistakable, boundless in significance, like Crusoe’s one savage footprint on the sea-shore: and the naturalist acknowledges the finger-mark of God, and wonders, and worships.

Happy, especially, is the sportsman who is also a naturalist: for as he roves in pursuit of his game, over hills or up the beds of streams where no one but a sportsman ever thinks of going, he will be certain to see things noteworthy, which the mere naturalist would never find, simply because he could never guess that they were there to be found. I do not speak merely of the rare birds which may be shot, the curious facts as to the habits of fish which may be observed, great as these pleasures are. I speak of the scenery, the weather, the geological formation of the country, its vegetation, and the living habits of its denizens. A sportsman out in all weathers, and often dependent for success on his knowledge of “what the sky is going to

do," has opportunities for becoming a meteorologist which no one beside but a sailor possesses ; and one has often longed for a scientific gamekeeper or huntsman, who, by discovering a law for the mysterious and seemingly capricious phenomena of "scent," might perhaps throw light on a hundred dark passages of hygrometry. The fisherman, too,—what an inexhaustible treasury of wonders lies at his feet, in the sub-aqueous world of the commonest mountain burn ! All the laws which mould a world are there busy, if he but knew it, fattening his trout for him, and making them rise to the fly, by strange electric influences, at one hour rather than at another. Many a good geognostic lesson too, both as to the nature of a country's rocks, and as to the laws by which strata are deposited, may an observing man learn as he wades up the bed of a trout-stream ; not to mention the strange forms and habits of the tribes of water-insects. Moreover no good fisherman but knows to his sorrow, that there are plenty of minutes, ay, hours, in each day's fishing, in which he would be right glad of any employment better than trying to

" Call spirits from the vasty deep,"

who will not

“Come when you do call for them.”

What to do then? You are sitting, perhaps, in your coracle, upon some mountain tarn, waiting for a wind, and waiting in vain.

“Keine luft an keine seite,
Todes-stille fürchterlich”;

As Göthe has it, —

“Und der schiffer sieht bekümmert
Glatte fläche rings umher.”

You paddle to the shore on the side whence the wind ought to come, if it had any spirit in it; tie the coracle to a stone, light your cigar, lie down on your back upon the grass, grumble, and finally fall asleep. In the mean while, probably, the breeze has come on, and there has been half an hour's lively fishing curl; and you wake just in time to see the last ripple of it sneaking off at the other side of the lake, leaving all as dead calm as before.

Now how much better, instead of falling asleep, to have walked quietly round the lake-side, and asked of your own brains and of nature the question, “How did this lake come here? What does it mean?”

It is a hole in the earth. True, but how was the hole made? There must have been huge

forces at work to form such a chasm. Probably the mountain was actually opened from within by an earthquake, and when the strata fell together again, the portion at either end of the chasm, being perhaps crushed together with greater force, remained higher than the centre, and so the water lodged between them. Perhaps it was formed thus. You will at least agree that its formation must have been a grand sight enough, and one during which a spectator would have had some difficulty in keeping his footing.

And when you learn that this convulsion probably took place at the bottom of an ocean, hundreds of thousands of years ago, you have at least a few thoughts over which to ruminate, which will make you at once too busy to grumble, and ashamed to grumble.

Yet after all, I hardly think the lake was formed in this way, and suspect that it may have been dry land for ages after it emerged from the primeval waves, and Snowdonia was a palm-fringed island in a tropic sea. Let us look the place over more carefully.

You see the lake is nearly circular ; on the side where we stand, the pebbly beach is not six feet above the water, and slopes away steeply

into the valley behind us, while before us, it shelves gradually into the lake; forty yards out, as you know, there is not ten feet water; and then a steep bank, the edge whereof we and the big trout know well, sinks suddenly to unknown depths. On the opposite side, that vast flat-topped wall of rock towers up shoreless into the sky, seven hundred feet perpendicular; the deepest water of all, we know, is at its very foot. Right and left, two shoulders of down slope into the lake. Now turn round and look down the gorge. Remark that this pebble-bank on which we stand reaches some fifty yards downward: you see the loose stones peeping out everywhere. We may fairly suppose that we stand on a dam of loose stones, a hundred feet deep.

But why loose stones? — and if so, what matter, and what wonder? There are rocks cropping out everywhere down the hill-side.

Because if you will take up one of these stones and crack it across, you will see that it is not of the same stuff as those said rocks. Step into the next field and see. That rock is the common Snowdon slate, which we see everywhere. The two shoulders of down.

right and left, are slate too ; you can see that at a glance. But the stones of the pebble-bank are a close-grained, yellow-spotted rock. They are Syenite ; and (you may believe me or not, as you will) they were once upon a time in the condition of hasty-pudding heated to some 800 degrees of Fahrenheit, and in that condition shoved their way up somewhere or other through these slates. But where ? whence on earth did these Syenite pebbles come ? Let us walk round to the cliff on the opposite side, and see. It is worth while ; for even if my guess be wrong, there is good spinning with a brass minnow round the angles of the rocks.

Now see. Between the cliff-foot and the sloping down is a crack, ending in a gully ; the nearer side is of slate, and the further side, the cliff itself, is — why, the whole cliff is composed of the very same stone as the pebble ridge !

Now, my good friend, how did those pebbles get three hundred yards across the lake ? Hundreds of tons, some of them three feet long : who carried them across ? The old Cymry were not likely to amuse themselves by making such a breakwater up here in No-man's-land, two thousand feet above the sea : but somebody, or

something, must have carried them; for stones do not fly, nor swim either.

Shot out of a volcano? As you seem determined to have a prodigy, it may as well be a sufficiently huge one.

Well — these stones lie all together; and a volcano would have hardly made so compact a shot, not being in the habit of using Ely's wire cartridges. Our next hope of a solution lies in John Jones, who carried up the coracle. Hail him, and ask him what is on the top of that cliff . . . So? "Plainshe and pogshe, and another Llyn." Very good. Now, does it not strike you that this whole cliff has a remarkably smooth and plastered look, like a hare's run up an earth-bank? And do you see that it is polished thus, only over the lake? that as soon as the cliff abuts on the downs right and left, it forms pinnacles, caves, broken angular boulders? Syenite usually does so in our damp climate, from the "weathering" effect of frost and rain: why has it not done so over the lake? On that part something (giants perhaps) has been scrambling up or down on a very large scale, and so rubbed off every corner which was inclined to come away, till the solid core of the rock

was bared. And may not those mysterious giants have had a hand in carrying the stones across the lake? . . . Really I am not altogether jesting. Think awhile what agent could possibly have produced either one, or both, of those effects?

There is but one ; and that, if you have been an Alpine traveller, much more if you have been a chamois hunter, you have seen many a time (whether you knew it or not) at the very same work.

Ice? Yes ; ice ; Hrymir the frost-giant, and no one else. And if you will look at the facts, you will see how ice may have done it. Our friend John Jones's report of plains and bogs and a lake above makes it quite possible that in the "Ice age" (Glacial Epoch, as the big-word-mongers call it) there was above that cliff a great *nevé*, or snowfield, such as you have seen often in the Alps at the head of each glacier. Over the face of this cliff a glacier has crawled down from that *nevé*, polishing the face of the rock in its descent : but the snow, having no large and deep outlet, has not slid down in a sufficient stream to reach the vale below, and form a glacier of the first order ; and has therefore stopped short on the other side of the lake, as a glacier of

the second order, which ends in an ice-cliff hanging high upon the mountain-side, and kept from further progress by daily melting. If you have ever gone up the *Mer de Glace* to the *Tacul*, you saw a magnificent specimen of this sort on your right hand, just opposite the *Tacul*, in the *Glacier de Trelaporte*, which comes down from the *Aiguille de Charmoz*.

This explains our pebble-ridge. The stones which the glacier rubbed off the cliff beneath it, it carried forward, slowly but surely, till they saw the light again in the face of the ice-cliff, and dropped out of it under the melting of the summer sun, to form a huge dam across the ravine; till the "Ice age" past, a more genial climate succeeded, and *nevé* and glacier melted away: but the "moraine" of stones did not, and remain to this day, the dam which keeps up the waters of the lake.

There is my explanation. If you can find a better, do; but remember always that it must include an answer to — "How did the stones get across the lake?"

Now, reader, we have had no abstruse science here, no long words, not even a microscope or a book: and yet we, as two plain sportsmen, have

gone back, or been led back by fact and common sense, into the most awful and sublime depths, into an epos of the destruction and re-creation of a former world.

This is but a single instance ; I might give hundreds. This one, nevertheless, may have some effect in awakening you to the boundless world of wonders which is all around you, and make you ask yourself seriously, "What branch of Natural History shall I begin to investigate, if it be but for a few weeks, this summer ?"

To which I answer, Try "the Wonders of the Shore." There are along every sea-beach more strange things to be seen, and those to be seen easily, than in any other field of observation which you will find in these islands. And on the shore only will you have the enjoyment of finding new species, of adding your mite to the treasures of science.

For not only the English ferns, but the natural history of all our land species, are now well-nigh exhausted. Our home botanists, entomologists, and ornithologists are spending their time now, perforce, in verifying a few obscure species, and bemoaning themselves like Alexander, that there are no more worlds left to conquer. For the

geologist, indeed, especially in the remotest districts, much remains to be done, but only at a heavy outlay of time, labor, and study ; and the dilettante (and it is for dilettanti, like myself, that I principally write) must be content to tread in the tracks of greater men who have preceded him, and accept at second and third hand their foregone conclusions.

But this is most unsatisfactory ; for in giving up discovery, one gives up one of the highest enjoyments of natural history. There is a mysterious delight in the discovery of a new species, akin to that of seeing for the first time in their native haunts, plants or animals of which one has till then only read. Some, surely, who read these pages, have experienced that latter delight ; and, though they might find it hard to define whence the pleasure arose, know well that it was a solid pleasure, the memory of which they would not give up for hard cash. Some, surely, can recollect at their first sight of the Alpine Soldanella, the Rhododendron, or the black Orchis, growing upon the edge of the eternal snow, a thrill of emotion, not unmingled with awe ; a sense that they were, as it were, brought face to face with the creatures of another world ;

that Nature was independent of them, not merely they of her ; that trees were not merely made to build their houses, or herbs to feed their cattle ; as they looked on those wild gardens amid the wreaths of the untrodden snow, which had lifted their gay flowers to the sun year after year since the foundation of the world, taking no heed of man, and all the coil which he keeps in the valleys far below.

And even, to take a simpler instance, there are those who will excuse, or even approve of a writer for saying that, among the memories of a month's eventful tour, those which stand out as beacon-points, those round which all the others group themselves, are the first wolf-track by the road-side in the Kyllwald ; the first sight of the blue and green Roller-birds, walking behind the plough like rooks in the tobacco-fields of Wittlich ; the first ball of Olivine scraped out of the volcanic slag-heaps of the Dreisser-Weiher ; the first pair of the Lesser Bustard which we flushed upon the downs of the Mosel-kopf ; the first sight of the cloud of white Ephemæræ, fluttering in the dusk like a summer snowstorm between us and the black cliffs of the Rheinstein, while the broad Rhine beneath flashed blood-red in the blaze of the

lightning and the fires of the Mausenthurm, a lurid Acheron above which seemed to hover ten thousand unburied ghosts; and last, but not least, on the lip of the vast Mosel-kopf crater, just above the point where the weight of the fiery lake has burst the side of the great slag-cup, and rushed forth between two cliffs of clink-stone across the downs, in a clanging stream of fire, damming up rivulets, and blasting its path through forests, far away toward the valley of the Moselle, the sight of an object for which was forgotten for the moment that battle-field of the Titans at our feet, and all the glorious panorama, Hundsruock and Taunus, Siebengebirge and Ardennes, and all the crater peaks around; and which was — smile not, reader — our first yellow foxglove.

But what is even this to the delight of finding a new species? — of rescuing (as it seems to you) one more thought of the divine mind from Hela, and the realms of the unknown, unclassified, uncomprehended? As it seems to you: though in reality it only seems so, in a world wherein not a sparrow falls to the ground unnoticed by our Father who is in heaven.

The truth is, the pleasure of finding new

species is too great ; it is morally dangerous ; for it brings with it the temptation to look on the thing found as your own possession, all but your own creation ; to pride yourself on it, as if God had not known it for ages since ; even to squabble jealously for the right of having it named after you, and of being recorded in the Transactions of I-know-not-what Society as its first discoverer : — as if all the angels in heaven had not been admiring it long before you were born or thought of.

But to be forewarned is to be forearmed ; and I seriously counsel you to try if you cannot find something new this summer along the coast to which you are going. There is no reason why you should not be as successful as a friend of mine, who, with a very slight smattering of science, and very desultory research, obtained last winter from the Torbay shores three entirely new species, beside several rare animals which had escaped all naturalists since the lynx-eye of Colonel Montagu discerned them forty years ago.

And do not despise the creatures because they are minute. No doubt we should both of us prefer helping Rajah Brooke to discover monstrous apes in the tropical forests of Borneo, or

stumbling with Hooker upon herds of gigantic "Ammon sheep" amid the rhododendron thickets of the Himalaya: but it cannot be; and "he is a fool," says old Hesiod, "who knows not how much better half is than the whole." Let us be content with what is within our reach. And doubt not that in these tiny creatures are mysteries more than we shall ever fathom.

The zoöphytes and microscopic animalcules which people every shore and every drop of water, have been now raised to a rank in the human mind, more important, perhaps, than even those gigantic monsters, whose models fill the lake at the New Crystal Palace. The research which has been bestowed, for the last century, upon these once unnoticed atomies, has well repaid itself; for from no branch of physical science has more been learnt of the *scientia scientiarum*, the priceless art of learning; no branch of science has more utterly confounded the wisdom of the wise, shattered to pieces systems and theories, and the idolatry of arbitrary names, and taught man to be silent while his Maker speaks, than this apparent pedantry of zoöphytology, in which our old distinctions of "animal," "vegetable," and

“mineral” are trembling in the balance, seemingly ready to vanish like their fellows, “the four elements” of fire, air, earth, and water. No branch of science has helped so much to sweep away that sensuous idolatry of mere size, which tempts man to admire and respect objects in proportion to the number of feet or inches which they occupy in space. No branch, moreover, has been more humbling to the boasted rapidity and omnipotence of the human reason, and taught those who have eyes to see, and hearts to understand, how weak and wayward, staggering and slow, are the steps of our fallen race (rapid and triumphant enough in that broad road of theories which leads to intellectual destruction) whensoever they tread the narrow path of true science, which leads (if I may be allowed to transfer our Lord’s great parable from moral to intellectual matters) to Life ; to the living and permanent knowledge of living things, and of the laws of their existence. Humbling, truly, to one who, in this summer of 1854, the centenary year of British zoöphytology, looks back to the summer of 1754, when good Mr. Ellis, the wise and benevolent West Indian merchant, read before the

Royal Society his famous paper proving the animal nature of corals, and followed it up the year after by that "Essay toward a Natural History of the Corallines, and other like Marine Productions of the British Coasts," which forms the groundwork of all our knowledge on the subject to this day. The chapter in Dr. G. Johnston's *British Zoöphytes*, p. 407, or the excellent little résumé thereof in Dr. Landsborough's book on the same subject, is really a saddening one, as one sees how loath were not merely dreamers like Marsigli or Bonnet, but sound-headed men like Pallas and Linné, to give up the old sense-bound fancy, that these corals were vegetables, and their polypes some sort of living flowers. Yet after all there are excuses for them. Without our improved microscopes, and while the sciences of comparative anatomy and chemistry were yet infantile, it was difficult to believe what was the truth; and for this simple reason; that, as usual, the truth, when discovered, turned out far more startling and prodigious than the dreams which men had hastily substituted for it; more strange than Ovid's old story that the coral was soft under the sea, and hardened by exposure to air; than

Marsigli's notion, that the coral-polypes were its flowers ; than Dr. Parsons' contemptuous denial, that these complicated forms could be "the operations of little, poor, helpless, jelly-like animals, and not the work of more sure vegetation"; than Baker the microscopist's detailed theory of their being produced by the crystallization of the mineral salts in the sea-water, just as he had seen "the particles of mercury and copper in aquafortis assume tree-like forms, or curious delineations of mosses and minute shrubs on slates and stones, owing to the shooting of salts intermixed with mineral particles": — one smiles at it now : yet these men were no less sensible than we of the year 1854 ; and if we know better, it is only because other men, and those few and far between, have labored amid disbelief, ridicule, and error ; needing again and again to retrace their steps, and to unlearn more than they learnt, seeming to go backwards when they were really progressing most ; and now we have entered into their labors, and find them, as I have just said, more wondrous than all the poetic dreams of a Bonnet or a Darwin. For who, after all, to take a few broad instances, (not to enlarge on the great root-wonder of a number of distinct individuals

connected by a common life, and forming a seeming plant invariable in each species,) would have dreamed of the “bizzareries” which these very zoöphytes present in their classification? You go down to any shore after a gale of wind, and pick up a few delicate little sea-ferns. You have two in your hand, which probably look to you, even under a good pocket-magnifier, identical or nearly so.* But you are told, to your surprise, that however alike the dead horny polypidoms which you hold may be, the two species of animal which have formed them are at least as far apart in the scale of creation as a quadruped is from a fish. You see in some Musselburgh dredger’s boat the phosphorescent sea-pen, (unknown in England,) a living feather, of the look and consistency of a cock’s comb; or the still stranger sea-rush, (*Virgularia mirabilis*,) a spine two feet long, with hundreds of rosy flowerets arranged in half-rings round it from end to end; and you are told that these are the congeners of the great stony Venus’s fan which hangs in seamen’s cottages, brought home from the West Indies. And

* *Sertularia operculata* and *Gemellaria loriculata*; or any of the small *Sertularia*, compared with *Crisis* and *Cellularia*, are very good examples.

ere you have done wondering, you hear that all three are congeners of the ugly, shapeless white "dead man's hand," which you may pick up after a storm on any shore. You have a beautiful madrepora or brainstone on your mantel-piece, brought home from some Pacific coral-reef. You are to believe that it has no more to do with the beautiful tubular corals among which it was growing, than a bird has with a worm, and that its first-cousins are the soft slimy sea-anemones which you see expanding their living flowers in every rock-pool, bags of sea-water, without a trace of bone or stone. You must believe it; for in science, as in higher matters, he who will walk surely must "walk by faith and not by sight."

These are but a few of the wonders which the classification of marine animals affords; and only drawn from one class of them, though almost as common among every other family of that submarine world whereof Spenser sang:—

"O what an endless work have I in hand,
To count the sea's abundant progeny!
Whose fruitful seed far passeth those in land,
And also those which won in th' azure sky.
For much more eath to tell the stars on high,

Albe they endless seem in estimation,
Than to recount the sea's posterity;
So fertile be the floods in generation,
So huge their numbers, and so numberless their nation."

But these few examples will be sufficient to account both for the slow pace at which the knowledge of sea-animals has progressed, and for the allurements which men of the highest attainments have found, and still find, in it. And when to this we add the marvels which meet us at every step in the anatomy and the reproduction of these creatures, and in the chemical and mechanical functions which they fulfil in the great economy of our planet, we cannot wonder at finding that books which treat of them carry with them a certain charm of romance, and feed the play of fancy, and that love of the marvellous which is inherent in man, at the same time that they lead the reader to more solemn and lofty trains of thought, which can find their full satisfaction only in self-forgetful worship, and that hymn of praise which goes up ever from land and sea, as well as from saints and martyrs and the heavenly host, "O, all ye works of the Lord, and ye, too, spirits and souls of the righteous, praise Him, and magnify Him for ever!"

I have said, that there were excuses for the old contempt of the study of Natural History. I have said too, it may be hoped, enough to show that contempt to be now ill-founded. But still, there are those who regard it as a mere amusement, and that as a somewhat effeminate one ; and think that it can at best help to while away a leisure hour harmlessly, and perhaps usefully, as a substitute for coarser sports, or for the reading of novels. Those, however, who have followed it out, especially on the sea-shore, know better. They can tell from experience, that over and above its accessory charms of pure sea-breezes, and wild rambles by cliff and loch, the study itself has had a weighty moral effect upon their hearts and spirits. There are those who can well understand how the good and wise John Ellis, amid all his philanthropic labors for the good of the West Indies, while he was spending his intellect and fortune in introducing into our tropic settlements the bread-fruit, the mangosteen, and every plant and seed which he hoped might be useful for medicine, agriculture, and commerce, could yet feel himself justified in devoting large portions of his ever well-spent time to the fighting the bat-

tle of the corallines against Parsons and the rest, and even in measuring pens with Linné, the prince of naturalists. There are those who can sympathize with the gallant old Scotch officer mentioned by some writer on sea-weeds, who, desperately wounded in the breach at Badajos, and a sharer in all the toils and triumphs of the Peninsular war, could in his old age show a rare sea-weed with as much triumph as his well-earned medals, and talk over a tiny spore-capsule with as much zest as the records of sieges and battles. Why not? That temper which made him a good soldier may very well have made him a good naturalist also. And certainly, the best naturalist, as far as logical acumen, as well as earnest research, is concerned, whom England has ever seen, was the Devonshire squire, Colonel George Montagu, of whom Mr. E. Forbes* well says, that "had he been educated a physiologist," (and not, as he was, a soldier and a sportsman,) "and made the study of nature his

* "British Star-fishes." This delightful writer, and eager investigator, has just died, in the prime of life, from disease contracted (it is said) during a scientific journey in Asia Minor: one more martyr to the knight-errantry of science.

aim and not his amusement, his would have been one of the greatest names in the whole range of British science." I question, nevertheless, whether he would not have lost more than he would have gained by a different training. It might have made him a more learned systematizer; but would it have quickened in him that "seeing eye" of the true soldier and sportsman, which makes Montagu's descriptions indelible word-pictures, instinct with life and truth? "There is no question," says Mr. E. Forbes, after bewailing the vagueness of most naturalists, "about the identity of any animal Montagu described. . . . He was a forward-looking philosopher; he spoke of every creature as if one exceeding like it, yet different from it, would be washed up by the waves next tide. Consequently his descriptions are permanent." Scientific men will recognize in this the highest praise which can be bestowed, because it attributes to him that highest faculty,—*The Art of Seeing*: but the study and the book would not have given that. It is God's gift, wheresoever educated: but its true school-room is the camp and the ocean, the prairie and the forest; active self-helping life, which can grapple with Nature

herself: not merely with printed books about her. Let no one think that this same natural history is a pursuit fitted only for effeminate or pedantic men. We should say rather, that the qualifications required for a perfect naturalist are as many and as lofty as were required, by old chivalrous writers, for the perfect knight-errant of the Middle Ages; for (to sketch an ideal, of which we are happy to say our race now affords many a fair realization) our perfect naturalist should be strong in body; able to haul a dredge, climb a rock, turn a boulder, walk all day, uncertain where he shall eat or rest; ready to face sun and rain, wind and frost, and to eat or drink thankfully anything, however coarse or meagre; he should know how to swim for his life, to pull an oar, sail a boat, and ride the first horse which comes to hand; and, finally, he should be a thoroughly good shot, and a skilful fisherman; and, if he go far abroad, be able on occasion to fight for his life.

For his moral character, he must, like a knight of old, be first of all gentle and courteous, ready and able to ingratiate himself with the poor, the ignorant, and the savage; not only because foreign travel will be often otherwise im-

possible, but because he knows how much invaluable local information can be only obtained from fishermen, miners, hunters, and tillers of the soil. Next, he should be brave and enterprising, and withal patient and undaunted ; not merely in travel, but in investigation ; knowing (as Lord Bacon might have put it) that the kingdom of nature, like the kingdom of heaven, must be taken by violence, and that only to those who knock long and earnestly does the great mother open the doors of her sanctuary. He must be of a reverent turn of mind also ; not rashly discrediting any reports, however vague and fragmentary ; giving man credit always for some germ of truth, and giving nature credit for an inexhaustible fertility and variety, which will keep him his life long always reverent, yet never superstitious ; wondering at the commonest, but not surprised by the most strange ; free from the idols of size and sensuous loveliness ; able to see grandeur in the minutest objects, beauty in the most ungainly ; estimating each thing not carnally, as the vulgar do, by its size or its pleasantness to the senses, but spiritually, by the amount of Divine thought revealed to him therein ; holding every phenomenon worth the noting down ;

believing that every pebble holds a treasure, every bud a revelation; making it a point of conscience to pass over nothing through laziness or hastiness, lest the vision once offered and despised should be withdrawn; and looking at every object as if he were never to behold it again.

Moreover, he must keep himself free from all those perturbations of mind which not only weaken energy, but darken and confuse the inductive faculty; from haste and laziness, from melancholy, testiness, pride, and all the passions which make men see only what they wish to see. Of solemn and scrupulous reverence for truth, of the habit of mind which regards each fact and discovery not as our own possession, but as the possession of its Creator, independent of us, our tastes, our needs, or our vainglory, we hardly need to speak; for it is the very essence of a naturalist's faculty, the very tenure of his existence: and without truthfulness, science would be as impossible now as chivalry would have been of old.

And last, but not least, the perfect naturalist should have in him the very essence of true chivalry, namely, self-devotion; the desire to

advance, not himself and his own fame or wealth, but knowledge and mankind. He should have this great virtue; and in spite of many short-comings, (for what man is there who liveth and sinneth not?) naturalists as a class have it, to a degree which makes them stand out most honorably in the midst of a self-seeking and mammonite generation, inclined to value everything by its money price, its private utility. The spirit which gives freely, because it knows that it has received freely; which communicates knowledge without hope of reward, without jealousy and mean rivalry, to fellow-students and to the world; which is content to delve and toil comparatively unknown, that from its obscure and seemingly worthless results others may derive pleasure, and even build up great fortunes, and change the very face of cities and lands, by the practical use of some stray talisman which the poor student has invented in his laboratory; —this is the spirit which is abroad among our scientific men, to a greater degree than it ever has been among any body of men, for many a century past; and might well be copied by those who profess deeper purposes, and a more exalted calling, than the discovery of a

new zoöphyte, or the classification of a moorland crag.

And it is these qualities, however imperfectly they may be realized in any individual instance, which make our scientific men, as a class, the wholesomest and pleasantest of companions abroad, and at home the most blameless, simple, and cheerful, in all domestic relations; men for the most part of manful heads, and yet of child-like hearts, who have turned to quiet study, in these late piping times of peace, an intellectual health and courage which might have made them, in more fierce and troublous times, capable of doing good service with very different instruments than the scalpel and the microscope.

I have been sketching an ideal: but one which I seriously recommend to the consideration of all parents; for, though it be impossible and absurd to wish that every young man should grow up a naturalist by profession, yet this age offers no more wholesome training, both moral and intellectual, than that which is given by instilling into the young an early taste for out-door physical science. The education of our children is now more than ever a puzzling problem, if by education we mean the develop-

ment of the whole humanity, not merely of some arbitrarily chosen part of it. How to feed the imagination with wholesome food, and teach it to despise French novels, and that sugared slough of sentimental poetry, in comparison with which the old fairy-tales and ballads were manful and rational ; how to counteract the tendency to shallow and conceited sciolism, engendered by hearing popular lectures on all manner of subjects, which can only be really learnt by stern methodic study ; how to give habits of enterprise, patience, accurate observation, which the counting-house or the library will never bestow ; above all, how to develop the physical powers, without engendering brutality and coarseness, — are questions becoming daily more and more puzzling, while they need daily more and more to be solved, in an age of enterprise, travel, and emigration, like the present. For the truth must be told, that the great majority of men who are now distinguished by commercial success have had a training the directly opposite to that which they are giving to their sons. They are for the most part men who have migrated from the country to the town, and had in their youth all the advantages of a sturdy and manful hill-side or sea-side training ;

men whose bodies were developed, and their lungs fed on pure breezes, long before they brought to work in the city the bodily and mental strength which they had gained by loch and moor. But it is not so with their sons. Their business habits are learnt in the counting-house ; a good school, doubtless, as far as it goes : but one which will expand none but the lowest intellectual faculties ; which will make them accurate accountants, shrewd computers and competitors, but never the originators of daring schemes, men able and willing to go forth to replenish the earth and subdue it. And in the hours of relaxation, how much of their time is thrown away, for want of anything better, on frivolity, not to say on secret profligacy, parents know too well ; and often shut their eyes in very despair to evils which they know not how to cure. A frightful majority of our middle-class young men are growing up effeminate, empty of all knowledge but what tends directly to the making of a fortune ; or rather, to speak correctly, to the keeping up the fortunes which their fathers have made for them ; while of the minority, who are indeed thinkers and readers, how many women as well as men have we seen wearying their souls with study undirected, often

misdirected ; craving to learn, yet not knowing how or what to learn ; cultivating, with unwholesome energy, the head at the expense of the body and the heart ; catching up with the most capricious self-will one mania after another, and tossing it away again for some new phantom ; gorging the memory with facts which no one has taught them to arrange, and the reason with problems which they have no method for solving ; till they fret themselves into a chronic fever of the brain, which too often urges them on to plunge, as it were to cool the inward fire, into the ever-restless sea of doubt and disbelief. It is a sad picture. There are many who may read these pages whose hearts will tell them that it is a true one. What is wanted in these cases is a methodic and scientific habit of mind ; and a class of objects on which to exercise that habit, which will fever neither the speculative intellect nor the moral sense ; and those physical science will give, as nothing else can give it.

Moreover, to revert to another point which we touched just now, man has a body as well as a mind ; and with the vast majority there will be no *mens sana* unless there be a *corpus sanum* for it to inhabit. And what out-door training to give

our youths is, as we have already said, more than ever puzzling. The difficulty is felt, perhaps, less in Scotland than in England. The Scotch climate compels hardiness; the Scotch bodily strength makes it easy; and Scotland, with her mountain-tours in summer, and her frozen lochs in winter, her labyrinth of sea-shore, and, above all, that priceless boon which Providence has bestowed on her, in the contiguity of her great cities to the loveliest scenery, and hills where every breeze is health, affords facilities for healthy physical life unknown to the Englishman, who has no Arthur's Seat towering above his London, no Western Islands spotting the ocean firths beside his Manchester. Field sports, with the invaluable training which they give, if not

“The reason firm,”

yet still

“The temperate will,

Endurance, foresight, strength, and skill,”

have become impossible for the greater number; and athletic exercises are now, in England at least, so artificialized, so expensive, so mixed up with drinking, gambling, and other evils of which we need say nothing here, that one cannot wonder at any parents' shrinking from allowing their sons to meddle much with them. And yet the

young man who has had no substitute for such amusements will cut but a sorry figure in Australia, Canada, or India ; and, if he stays at home, will spend many a pound in doctors' bills, which could have been better employed elsewhere. "Taking a walk" — as one would take a pill or a draught — seems likely soon to become the only form of out-door existence possible for us of the British Isles. But a walk without an object, unless in the most lovely and novel of scenery, is a poor exercise, and as a recreation utterly nil. We never knew two young lads go out for a "constitutional," who did not, if they were commonplace youths, gossip the whole way about things better left unspoken ; or, if they were clever ones, fall on arguing and brainsbeating on politics or metaphysics from the moment they left the door, and return with their wits even more heated and tired than they were when they set out. We cannot help fancying that Milton made a mistake in a certain celebrated passage ; and that it was not "sitting on a hill apart," but tramping four miles out and four miles in along a turnpike-road, that his hapless spirits discoursed

"Of fate, free-will, foreknowledge absolute,
And found no end, in wandering mazes lost."

Seriously, if we wish rural walks to do our children any good, we must give them a love for rural sights, an object in every walk; we must teach them—and we can teach them—to find wonder in every insect, sublimity in every hedge-row, the records of past worlds in every pebble, and boundless fertility upon the barren shore; and so, by teaching them to make full use of that limited sphere in which they now are, make them faithful in a few things, that they may be fit hereafter to be rulers over much.

I may seem to exaggerate the advantages of such studies; but the question after all is one of experience; and I have had experience enough and to spare, that what I say is true. I have seen the young man of fierce passions, and uncontrollable daring, expend healthily that energy which threatened daily to plunge him into recklessness, if not into sin, upon hunting out and collecting, through rock and bog, snow and tempest, every bird and egg of the neighboring forest. I have seen the cultivated man, craving for travel and for success in life, pent up in the drudgery of London work, and yet keeping his spirit calm, and perhaps his morals all the more righteous, by spending over his microscope even-

ings which would too probably have gradually been wasted at the theatre. I have seen the young London beauty, amid all the excitement and temptation of luxury and flattery, with her heart pure and her mind occupied in a boudoir full of shells and fossils, flowers and sea-weeds, and keeping herself unspotted from the world, by considering the lilies of the field, how they grow. And therefore it is that I hail with thankfulness every fresh book of Natural History, as a fresh boon to the young, a fresh help to those who have to educate them.

The greatest difficulty in the way of beginners is (as in most things) how to "learn the art of learning." They go out, search, find less than they expected, and give the subject up in disappointment. It is good to begin, therefore, if possible, by playing the part of "jackal" to some practised naturalist, who will show the tyro where to look, what to look for, and, moreover, what it is that he has found; often no easy matter to discover. Five-and-twenty years ago, during an autumn's work of dead-leaf-searching in the Devon woods for poor old Dr. Turton, while he was writing his book on British land-shells, the present writer learnt more of the art of observing

than he would have learnt in three years' desultory hunting on his own account; and he has often regretted that no naturalist has established shore-lectures at some watering-place, like those up hill and down dale field-lectures which, in pleasant bygone Cambridge days, Professor Sedgwick used to give to young geologists, and Professor Henslow to young botanists.

This want, however, bids fair to be supplied at last. That most pious and most learned naturalist, Mr. Gosse, whose works will be so often quoted in these pages, purposes, it is understood, to establish this summer a regular shore-class, probably at Weymouth. And I advise any reader whose fancy such a project pleases, to apply to him for details of the scheme, either at his own house, 58 Huntingdon Street, Barnsbury Park, Islington, or at the Linnæan or Microscopic Society.

In the mean while, to show something of what such a class might be, let me put myself, in imagination, in Mr. Gosse's place, and do his work for him for half an hour, though in a far more shallow and clumsy way.

Leaving Weymouth to him, let me take you to a shore where I am more at home, and for

whose richness I can vouch, and choose our season and our day to start forth, on some glorious morning of one of our Italian springs, to see what last night's easterly gale has swept from the populous shallows of Torbay, and cast up, high and dry, on Paignton sands.

Torbay is a place which should be as much endeared to the naturalist as to the patriot and to the artist. We cannot gaze on its blue ring of water, and the great limestone bluffs which bound it to the north and south, without a glow passing through our hearts, as we remember the terrible and glorious pageant which passed by in the glorious July days of 1588, when the Spanish Armada ventured slowly past Berry Head, with Elizabeth's gallant pack of Devon captains (for the London fleet had not yet joined) following fast in its wake, and dashing into the midst of the vast line, undismayed by size and numbers, while their kin and friends stood watching and praying on the cliffs, spectators of Britain's Salamis. The white line of houses, too, on the other side of the bay, is Brixham, famed as the landing-place of William of Orange; the stone on the pier-head, which marks his first footsteps on British ground, is sacred in the eyes

of all true English Whigs; and close by stands the castle of the settler of Newfoundland, Sir Humphrey Gilbert, Raleigh's half-brother, most learned of all Elizabeth's admirals in life, most pious and heroic in death. And as for scenery, though it can boast of neither mountain peak or dark fiord, and would seem tame enough in the eyes of a western Scot or Irishman, yet Torbay surely has a soft beauty of its own. The rounded hills slope gently to the sea, spotted with squares of emerald grass, and rich red fallow fields, and parks full of stately timber-trees. Long lines of tall elms, just flushing green in the spring hedges, run down to the very water's edge, their boughs unwarped by any blast; and here and there apple orchards are just bursting into flower in the soft sunshine, and narrow strips of water meadow line the glens, where the red cattle are already lounging knee-deep in richest grass, within ten yards of the rocky pebble beach. The shore is silent now, the tide far out: but six hours hence it will be hurling columns of rosy foam high into the sunlight, and sprinkling passengers, and cattle, and trim gardens which hardly know what frost and snow may be, but see the flowers of autumn meet the

flowers of spring, and the old year linger smilingly to twine a garland for the new.

No wonder that such a spot as Torquay, with its delicious Italian climate, and endless variety of rich woodland, flowery lawn, fantastic rock-cavern, and broad bright tide-sand, sheltered from every wind of heaven except the soft south-east, should have become a favorite haunt, not only for invalids, but for naturalists. Indeed, it may well claim the honor of being the original home of marine zoölogy and botany in England, as the Frith of Forth, under the auspices of Sir John Dalzell, has been for Scotland. For here worked Montagu, Turton, and Mrs. Griffith, to whose masculine powers of research English marine botany almost owes its existence, and who still survives, at an age long beyond the natural term of man, to see, in her cheerful and honored old age, that knowledge become popular and general, which she pursued for many a year unassisted and alone. And here too, now, Dr. Battersby possesses a collection of shells, inferior, perhaps, to hardly any in England. Torbay, moreover, from the variety of its rocks, aspects, and sea-floors, where limestones alternate with traps, and traps with slates, while at the valley-

mouths the soft sandstones and hard conglomerates of the new red series slope down into the tepid and shallow waves, affords an abundance and variety of animal and vegetable life, unequalled, perhaps, in any other part of Great Britain. It cannot boast, certainly, of those strange deep-sea forms which Messrs. Alder, Goodsir, and Laskey dredge among the lochs of the western Highlands, and the sub-marine mountain glens of the Zetland sea; but it has its own varieties, its own ever fresh novelties; and in spite of all the research which has been lavished on its shores, a naturalist cannot now work there for a winter without discovering forms new to science, or meeting with curiosities which have escaped all observers, since the lynx eye of Montagu espied them full fifty years ago.

Follow us, then, reader, in imagination, out of the gay watering-place, with its London shops and London equipages, along the broad road beneath the sunny limestone cliff, tufted with golden furze; past the huge oaks and green slopes of Tor Abbey; and past the fantastic rocks of Livermead, scooped by the waves into a labyrinth of double and triple caves, like Hindoo temples, upborne on pillars banded with

yellow and white and red, a week's study, in form and color and chiaro-oscuro, for any artist; and a mile or so further along a pleasant road, with landlocked glimpses of the bay, to the broad sheet of sand which lies between the village of Paignton and the sea,—sands trodden a hundred times by Montagu and Turton, perhaps, by Dillwyn and Gaertner, and many another pioneer of science. And once there, before we look at anything else, come down straight to the sea marge; for yonder lies, just left by the retiring tide, a mass of life such as you will seldom see again. It is somewhat ugly, perhaps, at first sight; for ankle-deep are spread, for some ten yards long by five broad, huge dirty shells, as large as the hand, each with its loathly gray and black tongue hanging out, a confused mass of slimy death. Let us walk on to some cleaner heap, and leave these, the great *Lutraria elliptica*, which have been lying buried by thousands in the sandy mud, each with the point of its long siphon above the surface, sucking in and driving out again the salt water on which it feeds, till last night's ground-swell shifted the sea bottom, and drove them up hither to perish helpless, but not useless, on the beach.

See, close by is another shell bed, quite as

large, but comely enough to please any eye. What a variety of forms and colors are there, amid the purple and olive wreaths of wrack, and bladder-weed, and tangle, (oar-weed, as they call it in the south,) and the delicate green ribbons of the *Zostera*, (the only English flowering plant which grows beneath the sea,) surely contradicting, as do several other forms, that somewhat hasty assertion of Mr. Ruskin, that nature makes no ribbons, unless with a midrib, and I know not what other limitations, which seem to me to exist only in Mr. Ruskin's fertile, but fastidious fancy. What are they all? What are the long white razors? What are the delicate green-gray scymitars? What are the tapering brown spires? What the tufts of delicate yellow plants, like squirrels' tails, and lobsters' horns, and tamarisks, and fir-trees, and all other finely cut animal and vegetable forms? What are the groups of gray bladders, with something like a little bud at the tip? What are the hundreds of little pink-striped pears? What those tiny babies' heads, covered with gray prickles instead of hair? The great red star-fish, which Ulster children call "the bad man's hands"; and the great whelks, which the youth of Musselburgh

know as “roaring buckies,” these we have seen ; but what, O what, are the red capsicums ? —

Yes, what are the red capsicums ? and why are they poking, snapping, starting, crawling, tumbling, wildly over each other, rattling about the huge mahogany cockles, as big as a man’s two fists, out of which they are protruded ? Mark them well, for you will perhaps never see them again. They are a Mediterranean species, or rather three species, left behind upon these extreme southwestern coasts, probably at the vanishing of the same warmer ancient epoch, which clothed the Lizard point with the Cornish heath, and the Killarney mountains with Spanish saxifrages, and other relics of a flora whose home is now the Iberian peninsula, and the sunny cliffs of the Riviera. Rare in every other shore, even in the west, it abounds in Torbay to so prodigious an amount, that the dredge, after five minutes’ scrape, will often come up choke full of this great cockle only. You will see tens of thousands of them in every cove for miles this day, and every heavy winter’s tide brings up an equal multitude, — a seeming waste of life, which would be awful in our eyes, were not the Divine Ruler, as His custom is, making this

destruction the means of fresh creation, by burying them in the sands, as soon as washed on shore, to fertilize the strata of some future world. It is but a shell-fish truly; but the great Cuvier thought it remarkable enough to devote to its anatomy elaborate descriptions and drawings, which have done more perhaps than any others to illustrate the curious economy of the whole class of bivalve, or double-shelled, mollusea. If you wish to know more about it than we can tell you, open Mr. Gosse's last book, the *Aquarium*, at p. 222.

“Many persons are aware that the common cockle can perform gymnastic feats of no mean celebrity, but the evolutions of Signor Tuberculato are worth seeing. Some of the troupe I had put into a pan of sea-water; others I had turned out into a dish dry, as knowing that an occasional exposure to the air is a contingency that they are not unused to. By and by, as we were quietly reading, our attention was attracted to the table where the dish was placed, by a rattling uproar, as if flint-stones were rolling one over the other about the dish. ‘O look at the cockles!’ was the exclamation; and they were indeed displaying their agility, and their beauty

too, in fine style. The valves of the largest were gaping to the extent of three quarters of an inch; but the intermediate space was filled up by the spongy-looking, fleshy mantle, of a semi-pellucid orange hue. At one end protruded the siphons, two thick, short tubes, soldered, as it were, into one, and enveloped on all sides in a shaggy fringe of *cirri*, or tentacles. The circular orifices of these tubes—small holes, perfectly round, with a white border—had a curious appearance, as we looked at the heart-shaped end of the valves. The discharging orifices, however, were but rarely visible, being usually closed, while the others remained constantly open. But these things were what we afterwards saw. For some time we could look at nothing but the magnificent foot, and the curious manner in which it was used.

“The two lips of the mantle suddenly separate, and, gaping widely all along the front, recede nearly to the valves; while at the same moment a huge organ is thrust out, somewhat like a tongue, nearly cylindrical, but a little flattened and tapering to a point. Its surface is smooth, and brilliantly glossy, and its color a fine rich scarlet, approaching to orange; but a better idea of it than can be conveyed by any descrip-

tion will be obtained by supposing it to be made of polished cornelian."

Hardly that, most amiable and amusing of naturalists: it is too opaque for cornelian; and the true symbol is, as I said before, in form, size, and color, one of those great red capsicums which hang drying in every Covent-Garden seedsman's window. Yet is your simile better than the guess of a certain Countess, who, entering a room wherein a couple of *Cardium tuberculatum* were waltzing about a plate, exclaimed, "O dear! I always heard that my pretty red coral came out of a fish, and here it is all alive!"

"This beautiful and versatile foot," continues Mr. Gosse, "is suddenly thrust out sideways, to the distance of four inches from the shell; then, its point being curved backwards, the animal pushes it strongly against any opposing object, by the resistance of which the whole animal, shell and all, makes a considerable step forwards. If the cockle were on its native sands, the leaps thus made would doubtless be more precise in their direction, and much more effective: but cooped up with its fellows, in a deep dish, all these Herculean efforts availed only to knock

the massive shells against the sides, or roll them irregularly over each other.

“It was curious to notice the extent to which the interior of the cockle was revealed, when the mouth gaped, and the foot was thrust out. By the aid of a candle we could see the interior surfaces of both valves, as it seemed, almost to the very backs. I say, *as it seemed*, for so thin is the mantle where it lines the shell, and so closely does it adhere to it, that every character of the valves, whether as regards color or irregularity of surface, was distinctly visible; and thus we were able to distinguish the species, not only by their external marks, but by one character drawn from the interior,—the ribs in *tuberculatum* extending only half-way across the valves, while in *aculeatum* they reach back to the beaks. The former is much the finer species; the valves are more globose and of a warmer color; those that I have seen are even more spinous. The mantle is of a rich deep orange, with elevated ribs, corresponding to those of the valves, of a yellow hue. These ribs of the mantle are visible in *aculeatum* also, but in *tuberculatum* they are much more strongly marked, both in form and color. The siphons

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display the same orange hue as the mantle-lips, and have a finer appearance than in the other species; the interior of the orifices in both is covered with a layer of white pearly substance, almost luminous. In the foot of *tuberculatum*, which agrees, in the particulars already mentioned, with that of its congener, I observed a beautiful opalescent gleam when under water."

"*C. tuberculatum*," continues Mr. Gosse, "is far the finest species. The valves are more globose and of a warmer color; those that I have are even more spinous." Such may have been the case in his specimens; but it has occurred to the writer now and then to dredge specimens of *C. aculeatum*, which had escaped that rolling on the sand fatal in old age to its delicate spines, and which equalled in color, size, and perfectness, the noble one figured in poor dear old Dr. Turton's "British Bivalves." Besides, *aculeatum* is a far thinner and more delicate shell. And a third species, *C. echinatum*, with curves more graceful and continuous, is to be found now and then with the two former, in which each point, instead of degenerating into a knot, as in *tuberculatum*, or developing from delicate, flat, brier-prickles into long, straight thorns, as in *aculeatum*,

is close-set to its fellow, and curved at the point transversely to the shell, the whole being thus horrid with hundreds of strong tenterhooks, making his castle impregnable to the raveners of the deep. For we can hardly doubt that these prickles are meant as weapons of defence, without which so savory a morsel as the mollusk within (cooked and eaten largely on some parts of our south coast) would be a staple article of food for sea beasts of prey. And it is noteworthy, first, that the defensive thorns, which are permanent on the two thinner species, *aculeatum* and *echinatum*, disappear altogether on the thicker one, *tuberculatum*, as old age gives him a solid and heavy globose shell; and next, that he too, while young and tender, and liable therefore to be bored through by whelks and such murderous univalves, does actually possess the same brier-prickles which his thinner cousins keep throughout life. Nevertheless, (and this is a curious fact, which makes, like most other facts, pretty strongly against the transmutation of species, and the production of organs by circumstances demanding them,) prickles, in all three species, are, as far as we can see, useless in Torbay, where no seal or wolf-fish, (*Anarrhichas lupus*),

or other shell-crushing pairs of jaws, wander, terrible to lobster and to cockle. Originally intended, as we suppose, to face the strong-toothed monsters of the Mediterranean, these foreigners have been left behind on shores where their armor is not now needed: and yet centuries of idleness and security have not been able to persuade them to lay it by; as it is written, "They continue this day as at the beginning; 'Thou hast given them a law which shall never be broken."

Enough of *Cardium tuberculatum*. What are the names of the other shells which you have gathered, any Introduction to Conchology will tell you; and the Sea-side Book will give you many a curious fact as to their habits. If you wish to know more, you must consult that new collection of true fairy tales, Dr. Johnston's "Lectures on Conchology." But the little pink pears are rare, hundreds of them as there happen to be here to-day. They are a delicate sea-anemone,* whose beautiful disc you may see well engraved in Gosse's "Naturalist in Devon." They adhere by thousands to the under-side of loose stones among the sand, and some colony of them has been uprooted by the

* *Actinia anguicomma*.

pitiless roll of the ground-swell, and drifted in here, sick and sad, but not so far gone but that each, in a jar of salt-water, will expand again into a delicate compound flower, whose "snake-locked" arms are all marbled with pellucid grays and browns, till they look like a living mist, hovering above the pink-striped cylinder of the body.

There are a hundred more things to be talked of here : but we must defer the examination of them till our return ; for it wants an hour yet of the dead low spring-tide ; and ere we go home, we will spend a few minutes at least on the rocks at Livermead, where awaits us a strong-backed quarryman, with a strong-backed crowbar, as is to be hoped, (for he snapped one right across there yesterday, falling miserably on his back into a pool thereby,) and we will verify Mr. Gosse's observation, that, —

"When once we have begun to look with curiosity on the strange things that ordinary people pass over without notice, our wonder is continually excited by the variety of phase, and often by the uncouthness of form, under which some of the meaner creatures are presented to us. And this is very specially the case with the inhabitants of the sea. We can scarcely poke or pry for an

hour among the rocks, at low-water mark, or walk, with an observant downcast eye, along the beach after a gale, without finding some oddly fashioned, suspicious-looking being, unlike any form of life that we have seen before. The dark concealed interior of the sea becomes thus invested with a fresh mystery; its vast recesses appear to be stored with all imaginable forms; and we are tempted to think there must be multitudes of living creatures whose very figure and structure have never yet been suspected.

‘O sea! old sea! who yet knows half
Of thy wonders or thy pride!’ ”

Gosse's Aquarium, pp. 226, 227.

But first, as after descending the gap in the sea-wall we walk along the ribbed floor of hard yellow sand, be so kind as to keep a sharp look-out for a round gray disc, about as big as a penny-piece, peeping out on the surface. No; that is not it, that little lump: open it, and you will find within one of the common little *Venus gallina*.—(They have given it some new name now, and no thanks to them: they are always changing the names, those closet collectors, instead of studying the live animals where Nature has put them, in which case they

would have no time for word-inventing. And we verily suspect that the names grow, like other things ; at least, they get longer and longer and more jaw-breaking every year.) The little bivalve, however, finding itself left by the tide, has wisely shut up its siphons, and, by means of its foot and its edges, buried itself in a comfortable bath of cool wet sand, till the sea shall come back, and make it safe to crawl and lounge about on the surface, smoking the sea-water instead of tobacco. Neither is that lump what we seek. Touch it, and out poke a pair of astonished and inquiring horns and a little sharp muzzle : it is a long-armed crab, who saw us coming, and wisely shovelled himself into the sand by means of his nether-end. Neither is that ; though it might be the hole down which what we seek has vanished : but that burrow contains one of the long white razors which you saw cast on shore at Paignton. The boys close by are boring for them with iron rods armed with a serew, and taking them in to sell in Torquay market, as excellent food. But there is one, at last !—a gray disc pouting up through the sand. Touch it, and it is gone down, quick as light. We must dig it out, and carefully, for it is a delicate monster. At last,

after ten minutes' careful work, we have brought up, from a foot depth or more — what? A thick, dirty, slimy worm, without head or tail, form or color. A slug has more artistic beauty about him. Be it so. At home in the aquarium, (where, alas! he will live but for a day or two, under the new irritation of light,) he will make a very different figure. That is one of the rarest of British sea-animals, *Actinia chrysanthellum*, though really he is no *Actinia*,* and his value consists, not merely in his beauty, (though that is not small,) but in his belonging to what the long-word-makers call an “interosculant” group, — a party of genera and species which connect families scientifically far apart, filling up a fresh link in the great chain, or rather the great network, of zoölogical classification. And here we have a simple, and, as it were, crude form; of which, if we dared to indulge in reveries, we might say, that the Divine Word realized it before either sea-anemones or holothurians, and then went on to perfect the idea contained in it in two different directions; dividing it into two different families, and making on its model, by adding new organs, and taking away old ones, in one direction the

* Now “*Penclia*,” of Mr. Gosse.

whole family of *Actiniæ*, (sea-anemones,) and in a quite opposite one the *Holothuriæ*, those strange sea-cucumbers, with their mouth-fringe of feathery gills, of which you shall see some anon. Not (understand well) that there has been any "transmutation" or "development of species," (of individuals, as it ought honestly to be called, if the notion is intended to represent a supposed fact,) — a theory as unsupported by experiment and induction, as it is by *à priori* reason: but that there has been, in the Creative Mind, as it gave life to new species, a development of the idea on which older species were created, in order that every mesh of the great net might gradually be supplied, and there should be no gaps in the perfect variety of Nature's forms. This development is the only one of which we can conceive, if we allow that a Mind presides over the universe, and not a mere brute necessity, a Law (absurd misnomer) without a Law-giver; and to it (strangely enough coinciding here and there with the Platonic doctrine of Eternal Ideas existing in the Divine Mind) all fresh inductive discovery seems to point more and more; and especially Professor Owen's invaluable tracts on the Homology of the Vertebrate Skeleton.

Let us speak freely a few words on this important matter. Geology has disproved the old popular belief that the universe was brought into being as it now exists, by a single fiat. We know that the work has been gradual ; that the earth

“ In tracts of fluent heat began,
The seeming prey of cyclic storms,
The home of seeming random forms,
Till, at the last, arose the man.”

And we know, also, that these forms, seeming random as they are, have appeared according to a law, which, as far as we can judge, has been only the whole one of progress, — lower animals (though we cannot say the lowest) appearing first, and man, the highest mammal, “the roof and crown of things,” one of the latest in the series. We have no more right, let it be observed, to say that man, the highest, appeared last, than that the lowest appeared first. Both may have been the case ; but there is utterly no proof of either ; and as we know that species of animals lower than those which already existed appeared again and again during the various eras, so it is quite possible that they may be appearing now, and may appear hereafter : and

that for every extinct Dodo or Moa a new species may be created, to keep up the equilibrium of the whole. This is but a surmise : but it may be wise, perhaps, just now, to confess boldly, even to insist on, its possibility, lest the advocates of the “Vestiges of Creation” theory should claim the notion as making for them, and fancy, from our unwillingness to allow it, that there would be aught in it, if proved, contrary to Christianity.

Let us, therefore, say boldly, that there has been a “progress of species,” and that there may be again, in the true sense of that term : but say, as boldly, that the Transmutation theory is not one of a progress of *species* at all, which would be a change in the idea of the species, taking place in the Divine Mind,—in plain words, the creation of a new species. What the Transmutationists really mean, if they would express themselves clearly, or carefully analyze their own notions, is a physical and actual change, not of species, but of *individuals*, of already existing living beings created according to one idea, into other living beings created according to another idea. And of this, in spite of the apparent change of species in the marvellous metamorphoses of lower animals, Nature has as yet given us no instance among

all the facts which have been observed; and there is, therefore, an almost infinite inductive probability against it. As far as we know yet, though all the dreams of the Transmutationists are outdone by the transformations of many a polype, yet the species remain as permanent and strongly marked as in the highest mammal. Such progress as experimental science actually shows us, is quite awful and beautiful enough to keep us our lives long in wonder; but it is one which perfectly agrees with, and may be perfectly explained by, the simple old belief, which the Bible sets before us, of a LIVING GOD: not a mere past will, such as the Koran sets forth, creating once and for all, and then leaving the universe, to use Goethe's simile, "to spin round his finger"; nor again, an "all-pervading spirit," words which are mere contradictory jargon, concealing, from those who utter them, blank Materialism: but One who works in all things which have obeyed Him to will and to do of His good pleasure, keeping His abysmal and self-perfect purpose, yet altering the methods by which that purpose is attained, from æon to æon, ay, from moment to moment, for ever various, yet for ever the same. This great and yet most blessed paradox

of the Changeless God, who yet can say, "It repenteth me," and, "Behold, I work a new thing on the earth," is revealed no less by nature than by Scripture; the changeableness, not of caprice or imperfection, but of an Infinite Maker and "Poietes," drawing ever fresh forms out of the inexhaustible treasury of the primeval mind; and yet never throwing away a conception to which He has once given actual birth in time and space, but (to compare reverently small things and great) lovingly repeating it, reapplying it; producing the same effects by endlessly different methods; or so delicately modifying the method that, as by the turn of a hair, it shall produce endlessly diverse effects; looking back, as it were, ever and anon over the great work of all the ages, to retouch it, and fill up each chasm in the scheme, which for some good purpose had been left open in earlier worlds; or leaving some open (the forms, for instance, necessary to connect the bimana and the quadrumana) to be filled up perhaps hereafter when the world needs them; the handiwork, in short, of a living and loving MIND, perfect in His own eternity, but stooping to work in time and space, and there rejoicing Himself in the work of His own hands,

and in His eternal Sabbaths ceasing in rest ineffable, that He may look on that which He hath made, and behold it is very good.

We speak, of course, under correction; for this conclusion is emphatically matter of induction, and must be verified or modified by ever-fresh facts: but we meet with many a Christian passage in scientific books, which seems to us to go, not too far, but rather not far enough, in asserting the God of the Bible, as Saint Paul says, "not to have left Himself without witness," in nature itself, that He is the God of grace. Why speak of the God of nature and the God of grace as two antithetical terms? The Bible never, in a single instance, makes the distinction; and, surely, if God be (as He is) the Eternal and Unchangeable One, and if (as we all confess) the universe bears the impress of His signet, we have no right, in the present infantile state of science, to put arbitrary limits of our own to the revelation which He may have thought good to make of Himself in nature. Nay, rather, let us believe that, if our eyes were opened, we should fulfil the requirement of Genius, to "see the universal in the particular," by seeing God's whole likeness, His whole glory, reflected as in a

mirror even in the meanest flower ; and that nothing but the dulness of our own sinful souls prevents them from seeing day and night in all things, however small or trivial to human eclecticism, the Lord Jesus Christ himself fulfilling his own saying, "My Father worketh hitherto, and I work."

And therefore, when we meet with such an excellent passage as this : * —

"Thus it is that Nature advances step by step, gradually bringing out, through successive stages of being, new organs and new faculties ; and leaving, as she moves along, at every step, some animals which rise no higher, as if to serve for landmarks of her progress through all succeeding time. And this it is which makes the study of comparative anatomy so fascinating. Not that I mean to favor a theory of '*development*,' which would obliterate all idea of species, by supposing that the more compound animal forms were developments of their simple ancestors. For such an hypothesis, Nature gives us no evidence : but she gives us, through all her domains, the most beautiful and diversified proofs of an adherence to a settled order, by which new com-

* Harvey's Sea-side Book, p. 166.

binations are continually brought out. In this order, the lowest grades of being have certain characters, above which they do not rise, but propagate beings as simple as themselves. Above them are others which, passing through stages in their infancy equal to the adult condition of those below them, acquire, when at maturity, a perfection of organs peculiarly their own. Others again rise above these, and their structures become gradually compound; till, at last, it may be said that the simpler animals represent, as in a glass, the scattered organs of the higher races."

— When we read such a passage as this, and confess, as we must, its truth, we cannot help sighing over certain expressions in it, which do unintentionally coincide with the very theory which Professor Harvey denies. Is this progress supposed to take place in time and space?—or in the mind of a Being above time and space, who afterwards reduces to act and fact, in time and space, just so much and no more of that progress as shall seem good to Him, some here, some there; not binding Himself to begin at the lowest, and end with the highest, but compensating and balancing the lower with the higher

in each successive stage of our planet? This last is what the Professor really means, we doubt not: but then, would that he had said boldly, that "God," and not "Nature," is the agent. So would he have raised at once the whole matter from the ground of destiny to that of will, from the material and logical ground to the moral and spiritual, from time and space into ever-present eternity. To us it seems (to sum up, in a few words, what we have tried to say) that such development and progress as have as yet been actually discovered in nature, have been proved, especially by Professor Sedgwick and Mr. Hugh Miller, to bear every trace of having been produced by successive acts of thought and will in some personal mind; which, however boundlessly rich and powerful, is still *the Archetype of the human mind*; and therefore (for to this we boldly confess we have been all along tending) probably capable, without violence to its properties, of becoming, like the human mind, INCARNATE.

This progress, then, in the Divine works, though tending ever to perfection in the very highest sense, need not be always forward and upward, according to the laws of comparative anatomy. It is possible, therefore, on the one

hand, that the idea of the *Chrysanthellum*, and its congeners *Scolanthus* and *Chirodota*, has been developed downwards into the far lower *Actinia*, as well as upwards into the higher *Holothurians*; just as the idea of a fish was first realized in the highest type of that class, and not, as has been too hastily supposed, in the lowest; for it is now discovered that the sharks, the earliest of fish, are really higher, not lower, in the scale of creation, than those salmons and perches which we from habit consider the archetypes and lords of the finny tribes. And it is equally possible that all our dream (though right in many another case, as in that of the shark just quoted) is here altogether wrong, and that these *Chrysanthella* are merely meant to fill up, for the sake of logical perfection, the space between the rooted *Polypes* and the free *Echinoderms*. Be this as it may, there is another, and more human, source of interest about this quaint animal who is wriggling himself clean in the glass jar of salt water; for he is one of the many curiosities which have been added to our fauna by that humble hero, Mr. Charles Peach, the self-taught naturalist of Cornwall, of whom, as we walk on toward the rocks, something should be said, or rather read; for

Mr. Chambers, in an often quoted passage from his *Edinburgh Journal*, which we must have the pleasure of quoting once again, has told the story better than we can tell it : —

“But who is that little intelligent-looking man in a faded naval uniform, who is so invariably to be seen in a particular central seat in this section? That, gentle reader, is perhaps one of the most interesting men who attend the British Association. He is only a private in the mounted guard (preventive service) at an obscure part of the Cornwall coast, with four shillings a day, and a wife and nine children, most of whose education he has himself to conduct. He never tastes the luxuries which are so common in the middle ranks of life, and even amongst a large portion of the working-classes. He has to mend with his own hands every sort of thing that can break or wear in his house. Yet Mr. Peach is a votary of Natural History ; not a student of the science in books, for he cannot afford books ; but an investigator by sea and shore, a collector of zoöphytes and echinodermata, strange creatures, many of which are as yet hardly known to man. These he collects, preserves, and describes ; and every year does he come up to the British Asso-

ciation with a few novelties of this kind, accompanied by illustrative papers and drawings: thus, under circumstances the very opposite of those of such men as Lord Enniskillen, adding, in like manner, to the general stock of knowledge. On the present occasion he is unusually elated, for he has made the discovery of a *Holothuria* with twenty tentacula, a species of the echinodermata which Professor Forbes, in his book on *Star-Fishes*, has said was never yet observed in the British seas. It may be of small moment to you, who, mayhap, know nothing of *Holothurias*: but it is a considerable thing to the Fauna of Britain, and a vast matter to a poor private of the Cornwall mounted guard. And accordingly he will go home in a few days, full of the glory of his exhibition, and strung anew by the kind notice taken of him by the masters of the science to similar inquiries, difficult as it may be to prosecute them under such a complication of duties, professional and domestic. But he has still another subject of congratulation, for Dr. Carpenter has kindly given him a microscope, wherewith to observe the structure of his favorite animals, an instrument for which he has sighed for many years in vain. Honest

Peach ! humble as is thy home, and simple thy bearing, thou art an honor even to this assemblage of nobles and doctors : nay, more, when we consider everything, thou art an honor to human nature itself ; for where is the heroism like that of virtuous, intelligent, independent poverty ? And such heroism is thine !” — *Chambers's Edinb. Journ.*, Nov. 23, 1844.

Mr. Peach is now, we are glad to say, rewarded in part for his long labors in the cause of science, by having been removed to a more lucrative post on the north coast of England ; the earnest, it is to be hoped, of still further promotion.

But here we are at the old bank of boulders, the ruins of an antique pier which the monks of Tor Abbey built for their convenience, while Torquay was but a knot of fishing huts within a lonely limestone cove. To get to it, though, we have passed many a hidden treasure ; for every ledge of these flat New-red-sandstone-rocks, if torn up with the crowbar, discloses in its cracks and crannies nests of strange forms which shun the light of day ; beautiful *Actiniae* fill the tiny caverns with living flowers ; great *Pholades* bore by hundreds in the softer strata ;

and wherever a thin layer of muddy sand intervenes between two slabs, long Annelid worms of quaintest forms and colors have their horizontal burrows, among those of that curious and rare radiate animal, the Spoonworm,* an eyeless bag about an inch long, half bluish-gray, half pink, with a strange scalloped and wrinkled proboscis of saffron color, which serves, in some mysterious way, soft as it is, to collect food, and clear its dark passage through the rock.

See, at the extreme low-water mark, where the broad olive fronds of the Laminariæ, like fan-palms, droop and wave gracefully in the retiring ripples, a great boulder which will serve our purpose. Its upper side is a whole forest of sea-weeds, large and small; and that forest, if you examined it closely, as full of inhabitants as those of the Amazon or the Gambia. To "beat" that dense cover would be an endless task; but on the under side, where no sea-weeds grow, we shall find full in view enough to occupy us till the tide returns. For the slab, see, is such a one as sea-beasts love to haunt. Its weed-covered surface shows that the surge has

* *Thalassema Neptuni* (Forbes's British Star-Fishes, p. 259).

not shifted it for years past. It lies on other boulders clear of sand and mud, so that there is no fear of dead sea-weed having lodged and decayed under it, destructive to animal life. We can see dark crannies and caves beneath ; yet too narrow to allow the surge to wash in, and keep the surface clean. It will be a fine menagerie of Nereus, if we can but turn it.

Now, the crowbar is well under it ; heave, and with a will ; and so, after five minutes' tugging, propping, slipping, and splashing, the boulder gradually tips over, and we rush greedily upon the spoil.

A muddy dripping surface it is, truly, full of cracks and hollows, uninviting enough at first sight : let us look it round leisurely, to see if there are not materials enough there for an hour's lecture.

The first object which strikes the eye is probably a group of milk-white slugs, from two to six inches long, cuddling snugly together. You try to pull them off, and find that they give you some trouble, such a firm hold have the delicate white sucking arms, which fringe each of their five edges. You see at the head nothing but a yellow dimple ; for eating and breathing are

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suspended till the return of tide: but once settled in a jar of salt water, each will protrude a large chocolate-colored head, tipped with a ring of ten feathery gills, looking very much like a head of "curled kale," but of the loveliest white and primrose; in the centre whereof lies *perdu* a mouth with sturdy teeth,—if indeed they, as well as the whole inside of the worthy fellow, have not been lately got rid of, and what you see be not a mere bag, without intestine or other organ: but only for the time being. For hear it, worn-out epicures, and old Indians who be-moan your livers, this little *Holothuria* knows a secret which, if he could tell it, you would be glad to buy of him for thousands sterling. To him blue-pill and muriatic acid are superfluous, and travels to German Brunnen a waste of time. Happy *Holothuria*! who possesses really that secret of everlasting youth, which ancient fable bestowed on the serpent and the eagle. For when his teeth ache, or his digestive organs trouble him, all he has to do is just to cast up forthwith his entire inside, and *faisant maigre* for a month or so, grow a fresh set, and then eat away as merrily as ever. His name, if you wish to consult so triumphant a hygeist, is *Cucumaria*

Hyndmanni, named after Mr. Hyndmann of Belfast, his first discoverer : but he has many a stout cousin round the Scotch coast, who knows the antibilious panacea as well as he, and submits, among the Northern fishermen, to the rather rude and undeserved name of sea-puddings ; one of which grows in Shetland to the enormous length of three feet, rivalling there his huge congeners, who display their exquisite plumes on every tropic coral reef.

Next, what are those bright little buds, like salmon-colored *Banksia* roses half expanded, sitting closely on the stone ? Touch them ; the soft part is retracted, and the orange flower of flesh is transformed into a pale pink flower of stone. That is the Madrepora, *Caryophyllia Smithii*, one of our south coast rarities ; and see, on the lip of the last one, which we have carefully scooped off with the chisel, two little pink towers of stone, delicately striated ; drop them into this small bottle of sea-water, and from the top of each tower issues every half second—what shall we call it ?—a hand or a net of finest hairs, clutching at something invisible to our grosser sense. That is the *Pyrgoma*, parasitic only (as far as we know) on the lip of this same rare

Madrepore; a little "cirrhipod," the cousin of those tiny barnacles which roughen every rock, and of those larger ones also who burrow in the thick hide of the whale, and, borne about upon his mighty sides, throw out their tiny casting-nets, as this *Pyrgoma* does, to catch every passing animaleule, and sweep them into the jaws concealed within its shell. And this creature, rooted to one spot through life and death, was in its infancy a free swimming animal, hovering from place to place upon delicate ciliæ, till, having sown its wild oats, it settled down in life, built itself a good stone house, and became a land-owner, or rather a *glebæ adscriptus*, for ever and a day. Mysterious destiny! — yet not so mysterious as that of the free medusoid young of every polype and coral, which ends as a rooted tree of horn or stone, and seems to the eye of sensuous fancy to have literally degenerated into a vegetable. Of them you must read for yourselves in Mr. Gosse's book; in the mean while he shall tell you something of the beautiful Madrepores themselves. His description,* by far the best yet published, should be read in full: we must content ourselves with extracts.

* A Naturalist's Rambles on the Devonshire Coast, p. 110.

“ Doubtless you are familiar with the stony skeleton of our Madrepora, as it appears in museums. It consists of a number of thin calcareous plates standing up edgewise, and arranged in a radiating manner round a low centre. A little below the margin, their individuality is lost in the deposition of rough calcareous matter. . . . The general form is more or less cylindrical, commonly wider at the top than just above the bottom. . . . This is but the skeleton; and though it is a very pretty object, those who are acquainted with it alone can form but a very poor idea of the beauty of the living animal. . . . Let it, after being torn from the rock, recover its equanimity; then you will see a pellucid gelatinous flesh emerging from between the plates, and little exquisitely formed and colored tentacula, with white clubbed tips fringing the sides of the cup-shaped cavity in the centre, across which stretches the oval disc marked with a star of some rich and brilliant color, surrounding the central mouth, a slit with white crenated lips, like the orifice of one of those elegant cowry-shells which we put upon our mantelpieces. The mouth is always more or less prominent, and can be protruded and

expanded to an astonishing extent. The space surrounding the lips is commonly fawn-color, or rich chestnut-brown ; the star or vandyked circle rich red, pale vermilion, and sometimes the most brilliant emerald green, as brilliant as the gorget of a humming-bird."

And what does this exquisitely delicate creature do with its pretty mouth? Alas for fact! It sips no honey-dew, or fruits from paradise.

"I put a minute spider, as large as a pin's head, into the water, pushing it down to the coral. The instant it touched the tip of a tentacle, it adhered, and was drawn in with the surrounding tentacles between the plates. With a lens I saw the small mouth slowly open, and move over to that side, the lips gaping unsymmetrically, while with a movement as imperceptible as that of the hour-hand of a watch, the tiny prey was carried along between the plates to the corner of the mouth. The mouth, however, moved most, and at length reached the edges of the plates, gradually closed upon the insect, and then returned to its usual place in the centre."

Mr. Gosse next tried the fairy of the walking mouth with a house-fly, who escaped only by

hard fighting; and at last the gentle creature, after swallowing and disgorging various large pieces of shell-fish, found viands to its taste in “the lean of cooked meat, and portions of earth-worms,” filling up the intervals by a perpetual dessert of microscopic animalcules, whirled into that lovely avernus, its mouth, by the currents of the delicate ciliæ which clothe every tentacle. The fact is, that the Madrepore, like those glorious sea-anemones whose living flowers stud every pool, is by profession a scavenger, and a feeder on carrion; and, being as useful as he is beautiful, really comes under the rule which he seems at first to break, that handsome is who handsome does.

Another species of Madrepore* was discovered on our Devon coast by Mr. Gosse, more gaudy, though not so delicate in hue as our Caryophyllia; three of which are at this moment pouting out their conical orange mouths and pointed golden tentacles in a vase on my table, at once grumbling and entreating for something to eat. Mr. Gosse’s locality, for this and numberless other curiosities, is Ilfracombe, on the north coast of Devon. These last specimens came from

* *Balanophyllia regia*, Coast of Devon, p. 399.

Lundy Island, in the mouth of the Bristol Channel, or more properly from that curious "Rat Island" to the south of it, where still lingers the black long-tailed English rat, exterminated everywhere else by his sturdier brown cousin of the Hanoverian dynasty.

Look, now, at these tiny saucers of the thinnest ivory, the largest not bigger than a silver threepence, which contain in their centres a milk-white crust of stone, pierced, as you see under the magnifier, into a thousand cells, each with its living architect within. Here are two sorts; in one the tubular cells radiate from the centre, giving it the appearance of a tiny compound flower, daisy or groundsel; in the other they are crossed with waving grooves, giving the whole a peculiar fretted look, even more beautiful than that of the former species. They are *Tubulipora patina* and *Tubulipora hispida*; — and stay, — break off that tiny rough red wart, and look at its cells also under the magnifier: it is *Cellepora pumicosa*; and now, with the Madrepora you hold in your hand, the principal, at least the commonest, British types of those famed coral insects, which in the tropics are the architects of continents, and the conquerors of the ocean

surge. All the world, since the publication of Darwin's delightful "Voyage of the Beagle," and of Williams's "Missionary Enterprises," knows, or ought to know, enough about them : for those who do not, there are a few pages in the beginning of Dr. Landsborough's "British Zoöphytes," well worth perusal.

There are a few other true cellepore corals round the coast. The largest of all, *Cervicornis*, may be dredged a few miles outside on the Exmouth bank, with a few more *Tubulipores* ; but all tiny things, the lingering, and, as it were, expiring remnants of that great coral-world, which, through the abysmal depths of past ages, formed here in Britain our limestone hills, storing up for generations yet unborn the materials of agriculture and architecture. Inexpressibly interesting, even solemn, to those who will think, is the sight of these puny parasites, which, as it were, connect the ages and the zones : yet not so solemn and full of meaning as that tiny relic of an older world, the little pear-shaped *Turbinolia*, (cousin of the *Madrepores* and *Sea-anemones*,) found fossil in the Suffolk Crag, and yet still lingering here and there alive in the deep water off Scilly and the west coast

of Ireland, possessor of a pedigree which dates, perhaps, from ages before the day in which it was said, "Let us make man in our image, after our likeness." To think that the whole human race, its joys and its sorrows, its virtues and its sins, its aspirations and its failures, has been rushing out of eternity and into eternity again, as Arjoon in the Bhagavad Gita beheld the race of men, issuing from Kreeshna's flaming mouth, and swallowed up in it again, "as the crowds of insects swarm into the flame, as the homeless streams leap down into the ocean bed," in an everlasting heart-pulse whose blood is living souls. And all that while, and ages before that mystery began, that humble coral, unnoticed on the dark sea-floor, has been "continuing as it was at the beginning," and fulfilling "the law which cannot be broken," while races and dynasties and generations have been

"Playing such fantastic tricks before high Heaven,
As make the angels weep."

Yes; it is this vision of the awful permanence and perfection of the natural world, beside the wild flux and confusion, the mad struggles, the despairing cries, of that world of spirits which

man has defiled by sin, which would at moments crush the naturalist's heart, and make his brain swim with terror, were it not that he can see by faith, through all the abysses and the ages, not merely

“ *Hands,*

From out the darkness, shaping man” ;

but ‘above them a living, loving countenance, human and yet divine ; and can hear a voice which said at first, “ Let us make man in our image ” ; and hath said since then, and says for ever and for ever, “ Lo, I am with you always, even to the end of the world.”

But now, friend, who listenest, perhaps instructed, and at least amused, if, as Professor Harvey well says, the simpler animals represent, as in a glass, the scattered organs of the higher races, which of your organs is represented by that “ sea’d man’s head,” which the Devon children more gracefully, yet with less adherence to plain likeness, call “ mermaid’s head,”* which we picked up just now on Paignton Sands ? Or which, again, by its more beautiful little congener,† five or six of which are adhering tightly to the slab before us, a ball covered with delicate

* *Amphidotus cordatus*.

† *Echinus miliaris*.

spines of lilac and green, and stuck over (cunning fellows !) with strips of dead sea-weed to serve as improvised parasols ? One cannot say (though Oken and the Okenists might) that in him we have the first type of the human skull ; for the resemblance, quaint as it is, is only sensuous and accidental, (in the logical use of that term,) and not homological, *i. e.* a lower manifestation of the same idea. Yet how is one tempted to say, that this was Nature's first and lowest attempt at that use of hollow globes of mineral for protecting soft fleshy parts, which she afterwards developed to such perfection in the skulls of vertebrate animals. But even that conceit, pretty as it sounds, will not hold good ; for though Radiates similar to these were among the earliest tenants of the abyss, yet as early as their time, perhaps even before them, had been conceived and actualized, in the sharks, and in Mr. Hugh Miller's pets, the old red sandstone fishes, that very true vertebrate skull and brain, of which this is a mere mockery.* Here the whole animal, with his extraordinary feeding-mill, (for neither teeth nor jaws is a fit word for it,) is

* See Professor Sedgwick's last edition of the Discourses on the Studies of Cambridge.

inclosed within an ever-growing limestone castle, to the architecture of which the Eddystone and the Crystal Palace are bungling heaps ; without arms or legs, eyes or ears, and yet capable, in spite of his perpetual imprisonment, of walking, feeding, and breeding, doubt it not, merrily enough. But this result has been attained at the expense of a complication of structure, which has baffled all human analysis and research into final causes. As much concerning this most miraculous of families as is needful to be known, and ten times more than is comprehended, may be read in Professor Harvey's Sea-Side Book, pp. 142-148, —pages from which you will probably arise with a dizzy sense of the infinity of nature, and a conviction that The Creative Word, so far from having commenced, as some fancy, with the simplest, and, as it were, easiest forms of life, took delight, as it were, in solving the most difficult and complicated problems first of all, with a certain divine prodigality of wisdom and of power ; and that before the mountains were brought forth, or ever the earth and the world was made, He was God from everlasting, the same yesterday, to-day, and for ever. Conceive a Crystal Palace, (for mere difference in size, as both the naturalist

and the metaphysician know, has nothing to do with the wonder,) whereof each separate joist, girder, and pane grows continually without altering the shape of the whole; and you have conceived only one of the miracles embodied in that little sea-egg, which The Divine Word has, as it were to justify to man His own immutability, furnished with a shell capable of enduring fossil for countless ages, that we may confess Him to have been as great when first His spirit brooded on the deep, as He is now, and will be through all worlds to come.

But we must make haste; for the tide is rising fast, and our stone will be restored to its eleven hours' bath, long before we have talked over half the wonders which it holds. Look though, ere you retreat, at one or two more.

What is that little brown fellow whom you have just taken off the rock to which he adhered so stoutly by his sucking-foot? A limpet? Not at all: he is of quite a different family and structure; but, on the whole, a limpet-like shell would suit him well enough, so he had one given him: nevertheless, owing to certain anatomical peculiarities, he needed one aperture more than a limpet; so one, if you will examine, has been

given him at the top of his shell.* This is one instance among a thousand of the way in which a scientific knowledge of objects must not obey, but run counter to, the impressions of sense; and of a custom in nature which makes this caution so necessary, namely, the repetition of the same form, slightly modified, in totally different animals, sometimes as if to avoid waste, (for why should not the same conception be used in two different cases, if it will suit in both?) and sometimes, (more marvellous by far,) when an organ fully developed and useful in one species, appears in a cognate species, but feeble, useless, and, as it were, abortive; and gradually, in species still farther removed, dies out altogether; placed there, it would seem, at first sight, merely to keep up the family likeness. I am half jesting; that cannot be the only reason, perhaps not the reason at all; but the fact is one of the most curious, and notorious also, in comparative anatomy.

Look, again, at those sea-slugs. One, some three inches long, of a bright lemon-yellow, clouded with purple; another of a dingy gray; †

* *Fissurella græca*.

† *Doris tuberculata* and *bilineata*.

another (exquisite little creature) of a pearly French white,* furred all over the back with what seem arms, but are really gills, of ringed white and gray and black. Put that yellow one into water, and from his head, above the eyes, arise two serrated horns, while from the after part of his back springs a circular Prince-of-Wales's feather of gills, — they are almost exactly like those which we saw just now in the white *Cucumaria*. Yes; here is another instance of that same custom of repetition. The *Cucumaria* is a low radiate animal, the sea-slug a far higher mollusk; and every organ within him is formed on a different type; as indeed are those seemingly identical gills, if you come to examine them under the microscope, having to oxygenate fluids of a very different and more complicated kind; and, moreover, the *Cucumaria*'s gills were put round his mouth; the *Doris*'s feathers round the other extremity; that gray *Eolis*'s, again, are simple clubs, scattered over his whole back, and in each of his nudibranch congeners these same gills take some new and fantastic form; in *Melibæa* those clubs are covered with warts; in *Scyllæa*, with tufted bouquets; in the beautiful

* *Felis papillosa*.

*Antropa** they are transparent bags; and in many other English species they take every conceivable form of leaf, tree, flower, and branch, bedecked with every color of the rainbow, as you may see them depicted in Messrs. Alder and Hancock's unrivalled Monograph on the Nudibranch Mollusca.

And now, worshipper of final causes and the mere useful in Nature, answer but one question, — Why this prodigal variety? All these Nudibranchs live in much the same way: why would not the same mould have done for them all? And why, again, (for we must push the argument a little further,) why have not all the butterflies, at least all who feed on the same plant, the same markings? Of all unfathomable triumphs of design, (we can only express ourselves thus, for honest induction, as Paley so well teaches, allows us to ascribe such results only to the design of some personal will and mind,) what surpasses that by which the scales on a butterfly's wing are arranged to produce a certain pattern of artistic beauty beyond all painter's skill? What a waste of power, on any utilitarian theory of nature! And once more; why are those

* Gosse's "Naturalist in Devon," p. 325.

strange microscopic atomies, the *Diatomaceæ* and *Infusoria*, which fill every stagnant pool, which fringe every branch of sea-weed, which form banks hundreds of miles long on the Arctic sea-floor, and the strata of whole moorlands, which pervade in millions the mass of every iceberg, and float aloft in countless swarms amid the clouds of the volcanic dust,—why are their tiny shells of flint as fantastically various in their quaint mathematical symmetry, as they are countless beyond the wildest dreams of the Pantheist? Mystery inexplicable on all theories of evolution by necessary laws, as well as on the conceited notion which, making man forsooth the centre of the universe, dares to believe that variety of forms has existed for countless ages in abysmal sea-depths and untrodden forests, only that some few individuals of the western races might, in these latter days, at last discover and admire a corner here and there of the boundless realms of beauty. Inexplicable, truly, if man be the centre and the object of their existence; explicable enough to him who believes that God has created all things for Himself, and rejoices in His own handiwork, and that the material universe is, as the wise man says, “A platform whereon His

eternal Spirit sports and makes melody." Of all the blessings which the study of nature brings to the patient observer, let none, perhaps, be classed higher than this ;— that the further he enters into those fairy gardens of life and birth, which Spenser saw and described in his great poem, the more he learns the awful and yet most comfortable truth, that they do not belong to him, but to one greater, wiser, lovelier than he ; and as he stands, silent with awe, amid the pomp of nature's ever-busy rest, hears, as of old, "The Word of the Lord God walking among the trees of the garden in the cool of the day."

One sight more, and we have done. We had something to say, had time permitted, on the ludicrous element which appears here and there in nature. There are animals, like monkeys and crabs, which seem made to be laughed at ; by those at least who possess that most indefinable of faculties, the sense of the ridiculous. As long as man possesses muscles especially formed to enable him to laugh, we have no right to suppose (with some) that laughter is an accident of our fallen nature ; or to find (with others) the primary cause of the ridiculous in the perception of unfitness or disharmony. And yet we shrink

(whether rightly or wrongly, we can hardly tell) from attributing a sense of the ludicrous to the Creator of these forms. It may be a weakness on our part ; at least we will hope it is a reverent one : but till we can find something corresponding to what we conceive of the Divine Mind in any class of phenomena, it is perhaps better not to talk about them at all, but observe a stoic "epoché," waiting for more light, and yet confessing that our own laughter is uncontrollable, and therefore we hope not unworthy of us, at many a strange creature and strange doing which we meet, from the highest ape to the lowest polype.

But, in the mean while, there are animals in which results so strange, fantastic, even seemingly horrible, are produced, that fallen man may be pardoned, if he shrinks from them in disgust. That, at least, must be a consequence of our own wrong state ; for everything is beautiful and perfect in its place. It may be answered, "Yes, in its place ; but its place is not yours. You had no business to look at it, and must pay the penalty for intermeddling." I doubt that answer ; for surely, if man have liberty to do anything, he has liberty to search out freely his Heavenly Father's work ; and yet every one

seems to have his antipathic animal ; and I know one bred from his childhood to zoölogy by land and sea, and bold in asserting, and honest in feeling, that all without exception is beautiful, who yet cannot, after handling and petting and admiring all day long every uncouth and venomous beast, avoid a paroxysm of horror at the sight of the common house-spider. At all events, whether we were intruding or not, in turning this stone, we must pay a fine for having done so ; for there lies an animal as foul and monstrous to the eye as “hydra, gorgon, or chimæra dire,” and yet so wondrously fitted to its work, that we must needs endure for our own instruction to handle and to look at it. Its name I know not, (though it lurks here under every stone,) and should be glad to know. It seems some very “low” Ascarid or Planarian worm. You see it? That black, shiny, knotted lump among the gravel, small enough to be taken up in a dessert-spoon. Look now, as it is raised and its coils drawn out. Three feet—six—nine, at least : with a capability of seemingly endless expansion ; a slimy tape of living caoutchouc, some eighth of an inch in diameter, a dark chocolate-black, with paler longitudinal lines.

Is it alive? It hangs helpless and motionless, a mere velvet string across the hand. Ask the neighboring Annelids and the fry of the rock fishes, or put it into a vase at home, and see. It lies motionless, trailing itself among the gravel; you cannot tell where it begins or ends; it may be a dead strip of sea-weed, *Himanthalia lorea* perhaps, or *Chorda filum*; or even a tarred string. So thinks the little fish who plays over and over it, till he touches at last what is too surely a head. In an instant a bell-shaped sucker mouth has fastened to his side. In another instant, from one lip, a concave double proboscis, just like a tapir's, (another instance of the repetition of forms,) has clasped him like a finger; and now begins the struggle: but in vain. He is being "played" with such a fishing-line as the skill of a Wilson or a Stoddart never could invent; a living line, with elasticity beyond that of the most delicate fly-rod, which follows every lunge, shortening and lengthening, slipping and twining round every piece of gravel and stem of sea-weed, with a tiring drag such as no Highland wrist or step could ever bring to bear on salmon or on trout. The victim is tired now; and slowly, and yet dexterously, his blind as-

sailant is feeling and shifting along his side, till he reaches one end of him ; and then the black lips expand, and slowly and surely the curved finger begins packing him end-foremost down into the gullet, where he sinks, inch by inch, till the swelling which marks his place is lost among the coils, and he is probably macerated to a pulp long before he has reached the opposite extremity of his cave of doom. Once safe down, the black murderer slowly contracts again into a knotted heap, and lies, like a boa with a stag inside him, motionless and blest.

There ; we must come away now, for the tide is over our ankles : but touch, before you go, one of those little red mouths which peep out of the stone. A tiny jet of water shoots up almost into your face. The bivalve * who has burrowed into the limestone knot (the softest part of the stone to his jaws, though the hardest to your chisel) is scandalized at having the soft mouths of his siphons so rudely touched, and taking your finger for some bothering Annelid, who wants to nibble him, is defending himself ; shooting you, as naturalists do humming-birds, with water. Let him rest in peace ; it will cost you ten minutes' hard

* *Saxicava rugosa*.

work, and much dirt, to extract him : but if you are fond of shells, secure one or two of those beautiful pink and straw-colored scallops,* who have gradually incorporated the layers of their lower valve with the roughnesses of the stone, destroying thereby the beautiful form which belongs to their race, but not their delicate color. There are a few more bivalves too, adhering to the stone, and those rare ones, and two or three delicate *Mangelicæ* and *Nusæ* are trailing their graceful spires up and down in search of food. That little bright red and yellow pea, too, touch it.—the brilliant colored cloak is withdrawn, and, instead, you have a beautifully ribbed pink cowry.† our only European representative of that grand tropical family. Cast one wondering glance, too, at the forest of zoöphytes and corals, *Lepraliæ* and *Flustræ*, and those quaint blue stars, set in brown jelly, which are no zoöphytes, but respectable mollusks, each with his well-formed mouth and intestine,‡ but combined in a peculiar form of Communism, of which all one can say is, that one hopes they like it ; and that, at all events, they agree better than the heroes and heroines of Mr. Hawthorne's Blithedale Romance.

* *Pecten* sp.† *Cypræa Europæa*.‡ *Botrylli*.

Now away, and as a specimen of the fertility of the water-world, look at this rough list of species,* the greater part of which are on this very stone, and all of which you might obtain in an hour, would the rude tide wait for zoölogists; and remember, that the number of individuals of each species of polype must be counted by tens of thousands, and also, that, by searching the forest of sea-weeds which covers the upper

* *Mollusks.*

Doris tuberculata.	Anomiæ,—2 or 3 spe-	Sertularia fallax.
— bilineata.	cies.	— filicula.
Eolis papillosa.	Cynthia,—2 species.	Plumularia falcata.
Pleurobranchus plu-	Botryllus, do.	— setacea.
mula.	Sydinum?	Laomedea geniculata.
Neritina.		Campanularia volubi-
Cypræa.	<i>Annelids.</i>	lis.
Trochus,—2 species.	Phyllodoce, and other	Aetinia mesembryan-
Mangelia.	Nereid worms.	themum.
Triton.	Polynoe squamata.	— clavata.
Trophon.		— anguicomma.
Nasa,—2 species.	<i>Crustacea.</i>	— crassicornis.
Cerithium.	4 or 5 species.	Tubulipora patina.
Sigaretus.	<i>Echinoderms.</i>	— hispida.
Fissurella.		— serpens.
Area lactea.	Echiniis miliaris.	Crisia eburnea.
Pecten pusio.	Asterias gibbosa.	Cellepora pumicosa.
Tapes pullastra.	Ophiocoma neglecta.	Lepraliæ,—many spe-
Kellia suborbicula-	Cucumaria Hynd-	cies.
ris.	manni.	Membranipora pilosa.
Sphæria Binghami.	— communis.	Cellularia ciliata.
Saxicava rugosa.		— seruposa.
Gastrochæna phola-	<i>Polypes.</i>	— reptans.
dia.	Sertularia pumila.	Flustra membrana-
Pholas parva.	— rugosa.	cea, &c.

surface, we should probably obtain some twenty minute species more.

A goodly catalogue this, surely, of the inhabitants of three or four large stones; and yet how small a specimen of the multitudinous nations of the sea. From the bare rocks above high-water mark, down to abysses deeper than ever plummet sounded, is life, everywhere life; fauna after fauna, and flora after flora, arranged in zones, according to the amount of light and warmth which each species requires, and to the amount of pressure which they are able to endure. The crevices of the highest rocks, only sprinkled with salt spray in spring-tides and high gales, have their peculiar little univalves, their crisp lichen-like sea-weeds, in myriads; lower down, the region of the *Fuci* (bladder-weeds) has its own tribes of periwinkles and limpets; below again, about the neap-tide mark, the region of the corallines and *Algae* furnishes food for yet other species who graze on its watery meadows; and beneath all, only uncovered at low spring-tide, the zone of the *Laminariae* (the great tangles and oar-weed) is most full of all of every imaginable form of life. So that as we descend the rocks, we may compare ourselves (likening small things

to great) to those who, descending the Andes, pass in a single day from the vegetation of the Arctic zone to that of the Tropics. And here and there, even at half-tide level, deep rock-basins, shaded from the sun and always full of water, keep up in a higher zone the vegetation of a lower one, and afford in miniature an analogy to those deep "barrancos" which split the high table-land of Mexico, down whose awful cliffs, swept by cool sea-breezes, the traveller looks from among the plants and animals of the temperate zone, and sees far below, dim through their everlasting vapor-bath of rank hot steam, the mighty forms and gorgeous colors of a tropic forest.

"I do not wonder," says Mr. Gosse, in his charming "Naturalist's Rambles on the Devonshire Coast,"* "that when Southey had an opportunity of seeing some of those beautiful quiet basins hollowed in the living rock, and stocked with elegant plants and animals, having all the charm of novelty to his eye, they should have moved his poetic fancy, and found more than one place in the gorgeous imagery of his Oriental romances. Just listen to him :—

* P. 187.

“ It was a garden still beyond all price,
Even yet it was a place of paradise ;

And here were coral bowers,
And grots of madrepores,
And banks of sponge, as soft and fair to eye
As e'er was mossy bed
Whereon the wood-nymphs lie
With languid limbs in summer's sultry hours.
Here, too, were living flowers,
Which, like a bud compacted,
Their purple cups contracted ;
And now in open blossom spread,
Stretched, like green anthers, many a seeking head.
And arborets of jointed stone were there,
And plants of fibres fine as silkworm's thread ;
Yea, beautiful as mermaid's golden hair
Upon the waves dispread.
Others that, like the broad banana growing,
Raised their long wrinkled leaves of purple hue,
Like streamers wide outflowing.' — *Kchama*, xvi. 5.

“ A hundred times you might fancy you saw the type, the very original of this description, tracing, line by line, and image by image, the details of the picture ; and acknowledging, as you proceed, the minute truthfulness with which it has been drawn. For such is the loveliness of nature in these secluded reservoirs, that the accomplished poet, when depicting the gorgeous scenes of Eastern mythology, — scenes the wildest and most extravagant that imagination could

paint, drew not upon the resources of his prolific fancy for imagery here, but was well content to jot down the simple lineaments of nature as he saw her in plain, homely England.

“It is a beautiful and fascinating sight for those who have never seen it before, to see the little shrubberies of pink coralline — ‘the arborets of jointed stone’ — that fringe those pretty pools. It is a charming sight to see the crimson banana-like leaves of the *Delesseria* waving in their darkest corners; and the purple fibrous tufts of *Polysiphoniæ* and *Ceramia*, ‘fine as silkworm’s thread.’ But there are many others which give variety and impart beauty to these tide-pools. The broad leaves of the *Ulva*, finer than the finest cambric, and of the brightest emerald-green, adorn the hollows at the highest level, while, at the lowest, wave tiny forests of the feathery *Ptilota* and *Dasya*, and large leaves, cut into fringes and furbelows, of rosy *Rhodymeniæ*. All these are lovely to behold; but I think I admire as much as any of them one of the commonest of our marine plants, *Chondrus crispus*. It occurs in the greatest profusion on this coast, in every pool between tide-marks; and everywhere, — except in those of the highest level,

where constant exposure to light dwarfs the plant, and turns it of a dull umber-brown tint, — it is elegant in form and brilliant in color. The expanding fan-shaped fronds, cut into segments, cut, and cut again, make fine bushy tufts in a deep pool, and every segment of every frond reflects a flush of the most lustrous azure, like that of a tempered sword-blade.” — *Gosse’s Devonshire Coast*, pp. 187 – 189.

And the sea-bottom, also, has its zones, at different depths, and its peculiar forms in peculiar spots, affected by the currents and the nature of the ground, the riches of which have to be seen, alas ! rather by the imagination than the eye ; for such spoonfuls of the treasure as the dredge brings up to us come too often rolled and battered, torn from their sites and contracted by fear, mere hints to us of what the populous reality below is like. And often, standing on the shore at low tide, has one longed to walk on and in under the waves, as the water-ousel does in the pools of the mountain burn, and see it all but for a moment ; and a solemn beauty and meaning has invested the old Greek fable of Glaucus the fisherman, how he ate of the herb which gave his fish strength to leap

back into their native element, was seized on the spot with a strange longing to follow them under the waves, and became for ever a companion of the fair semi-human forms with which the Hellenic poets peopled their sunny bays and firths, feeding his "silent flocks" far below on the green *Zostera* beds, or basking with them on the sunny ledges in the summer noon, or wandering in the still bays on sultry nights amid the choir of Amphitrite and her sea-nymphs,

"Joining the bliss of the gods, as they waken the coves with their laughter,"

in nightly revels, whereof one has sung, —

"So they came up in their joy; and before them the roll of the surges

Sank, as the breezes sank dead, into smooth green foam-flecked marble

Awed; and the crags of the cliffs and the pines of the mountains were silent.

So they came up in their joy, and around them the lamps of the sea-nymphs,

Myriad fiery globes, swam heaving and panting, and rainbows,

Crimson and azure and emerald, were broken in star-showers, lighting,

Far in the wine-dark depths of the crystal, the gardens of Nereus,

Coral and sea-fan and tangle, the blooms and the palms of the ocean.

So they went on in their joy, more white than the foam which
 they scattered,
 Laughing and singing and tossing and twining, while, eager,
 the Tritons
 Blinded with kisses their eyes, unreprieved, and above them in
 worship
 Fluttered the terns, and the sea-gulls swept past them on
 silvery pinions,
 Echoing softly their laughter; around them the wantoning
 dolphins
 Sighed as they plunged, full of love; and the great sea-horses
 which bore them
 Curved up their crests in their pride to the delicate arms of
 their riders,
 Pawing the spray into gems, till a fiery rainfall, unharmed,
 Sparkled and gleamed on the limbs of the maids, and the coils
 of the mermen.
 So they went on in their joy, bathed round with the fiery
 coolness,
 Needing nor sun nor moon, self-lighted, immortal: but others,
 Piteous, floated in silence apart; on their knees lay the sea-
 boys
 Whelmed by the roll of the surge, swept down by the anger
 of Nerens;
 Hapless, whom never again upon quay or strand shall their
 mothers
 Welcome with garlands and vows to the temples; but, wearily
 pining,
 Gaze over island and main for the sails which return not;
 they heedless
 Sleep in soft bowms for ever, and dream of the surge and the
 sea-maids.
 So they pass by in their joy, like a dream, down the murmur-
 ing ripples."

Such a rhapsody may be somewhat out of order, even in a popular scientific book ; and yet one cannot help at moments envying the old Greek imagination, which could inform the soulless sea-world with a human life and beauty. For after all, star-fishes and sea-anemones are dull substitutes for Sirens and Tritons ; the lamps of the sea-nymphs, those glorious phosphorescent medusæ whose beauty Mr. Gosse sets forth so well with pen and pencil, are not as attractive as the sea-nymphs themselves would be ; and who would not, like Menelaus, take the gray old man of the sea himself, asleep upon the rocks, rather than one of his seal-herd, probably too with the same result as the world-famous combat in the Antiquary, between Hector and Phoca ? And yet — is there no human interest in these pursuits, more human, ay, and more divine, than there would be even in those Triton and Nereid dreams, if realized to sight and sense ? Heaven forbid that those should say so, whose wanderings among rock and pool have been mixed up with holiest passages of friendship and of love, and the intercommunion of equal minds and sympathetic hearts, and the laugh of children drinking in health from every breeze, and instruction at every step, running ever and

anon with proud delight to add their little treasure to their parents' stock, and of happy friendly evenings spent over the microscope and the vase, in examining, arranging, preserving, noting down in the diary the wonders and the labors of the happy, busy day. No; such short glimpses of the water-world as our present appliances afford us are full enough of pleasure; and we will not envy Glaucus; we will not even be over-anxious for the success of his only modern imitator, the French naturalist who is reported to have just fitted himself with a water-proof dress and breathing apparatus, in order to walk the bottom of the Mediterranean, and see for himself how the world goes on at the fifty-fathom line. We will be content with dredging next year as we dredged this; and in the mean while let Mr. Gosse tell us some of the pleasures of that little-known amusement:—

“The dredge is a strong bag with an iron frame around the mouth, which is drawn over the sea-bottom by a rope. The rudest form of the instrument is that used for procuring oysters. The bag is generally made of iron rings linked together, and one of the longer sides of the frame is turned up to make a scraping-lip.

“ But the naturalists’ dredge is an improvement upon this form ; the oyster-dredge, with all the care employed in heaving, will frequently turn over in sinking, so that the unlippped side of the frame which will not scrape is on the ground. Hence we have each of the two long sides of the mouth made into a scraping-lip, so that the instrument cannot fall wrong. Instead of rings our body is made of spun-yarn (a sort of small rope) or fishing-line, netted with a small mesh ; or, which is still better, of a raw hide, (such as those which the tobaccoists receive from South America inclosing tobacco, the hides of the wild cattle of the Pampas,) cut into thongs, and netted in like manner. Sometimes the bag is made of coarse sackcloth, or of canvas, but the former soon wears out, and the latter is not sufficiently pervious to water ; an important point, for if there be not a free current through the bag, while on the bottom, it embraces nothing, merely driving everything before it, and coming up empty. The hide-net is almost indestructible.

“ To the two ends, or short sides of the frame, which forms an oblong square, are attached by a hinge two long triangles, which, meeting in front

at some distance from the mouth, are connected by a swivel-joint. To this the dragging rope is bent, which must be long enough to allow thrice as much at least to be overboard as the perpendicular depth would require ; if you are dredging in ten fathoms, you must use at least thirty fathoms of line, or your dredge will make long jumps over the ground instead of steadily raking it. The inward end of the rope having been made fast to one of the thwarts, the dredge is hove to windward, and the boat is put before the wind, or at least allowed a flowing sheet.

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“ But before we ran down to our dredging-ground, my master of the ceremonies proposed that we should haul up a point or two, and have a scrape on the *Zostera* beds that cover many acres of shallow water in the bight of Preston Valley. But let me introduce my man to you. A clever fellow is Jone, and though only bred as a fisherman, he is quite an amateur naturalist. There is nobody else in Weymouth harbor that knows anything about dredging ; (I have it from his own lips, so you may rely upon it ;) but *he* is familiar with the feel of almost every yard of

bottom from Whitenose to Church-Hope, and from St. Aldham's Head to the Bill. He follows dredging with the zest of a *savant*; and it is amusing really to hear how he pours forth the crackjaw, the sesquipedalian nomenclature. 'Now, Sir, if you do want a *Gastrochaena*, I can just put down your dredge upon a lot of 'em; we 'll bring up three and four in a stone.' 'I 'm in hopes we shall have a good *Cribella* or two off this bank, if we don't get choked up with them 'ere *Ophiocomas*.' He tells me in confidence that he has been sorely puzzled to find a name for his boat, but has at length determined to appellate her 'The Turritella; just to astonish the fishermen, you know, Sir,' — with an accompanying wink and chuckle, and a patronizing nudge in my ribs. Jone is a proud man when he gets a real *savant* alone in a boat; and he talks with delight of the feats which he has achieved in the dredging line for Mr. Bowerbank, Mr. Hanley, and Professor Forbes.

“ Well, here we are in the bight, just off the mouth of Preston Valley, the only bit of pretty scenery anywhere near. This, however, is a little gem; a verdant dell opening to the sea, through

which a streamlet runs, with the sides and bottom covered with woods, a rare feature in this neighborhood. We are over the *Zostera*: the beds of dark green grass are waving in the heave of the swell, and we can make out the long and narrow blades by closely looking down beneath the shadow of the boat. Here then is the place for the keer-drag. Down it goes and sinks into the long grass, while we slowly drag it for a couple of hundred yards or so.

“When disposed to try our luck, we hauled on the rope till we got the mouth of the drag to the top of the water; a turn or hitch was then taken round a belaying pin, with the two side lines of the bridle, and the point of the net only was then hauled on board, put into a pan of water and untied. Here was congregated the chief part of the prey taken, and hence the need of having the meshes so small in this part. Out swam in a moment a good many little fishes that haunt the grass-bed; as Pipe-fishes (*Syngnathus*) of several species, Gobies (*Gobius unipunctatus*, &c., &c.) and bright blue Conners (*Labrus* and *Crenilabrus*). With these were two or three active and charming Cuttles (*Sepiola*); and clinging to the meshes of the net in various parts

were several species of Nudibranch Mollusca, creatures of remarkable elegance and beauty.

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“Meanwhile we put the boat before the wind, and run along the inhospitable coast on our left. We leave the pleasant vale behind, and skim swiftly by the black rocks of Ratcliff Head, and the distorted and confused strata of Goggin’s Berrow. We pass Osmington Mills, where a rather ample sheet of water is poured in a foaming cascade over the low cliffs, and where those curious circular blocks of grit-stone, flat on one side and conical on the other, are imbedded with regularity on the sandy face of the precipice: and leave on our quarter the rocks, where the abundance of iron pyrites and sulphur has more than once presented the strange phenomenon of spontaneous fire; a phenomenon distinctly remembered still by the inhabitants of Weymouth, who night after night used to gaze out with wonder on the burning cliffs.

“At length we are under Whitenose, that bold chalk cliff that is so prominent an object as the eye roves along the coast line from Weymouth. Here we turn the boat’s edge to the southward, and throw the dredge overboard in fourteen

fathoms. And while I am enjoying with the line in my hand, what a dredger particularly likes to feel, the vibration produced by the instrument as it rumbles and scrapes over a moderately rough bottom, telling that it is doing its work well, we will gaze with admiration on this magnificent precipice of dazzling white that rears its noble head behind us. It is the termination of that range of chalk hills which, with some few interruptions, intersect the kingdom from the Yorkshire coast to Dorset : and stands in simple majesty, the snowy whiteness of its vast face unvaried, except by the slanting lines which mark the dipping strata running across it, and which look so fine and so regular, as if they had been drawn by the pen of a geometrician.

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“ But up with the dredge ; let us see our success. It feels pretty heavy as it mounts, and here, as it breaks the surface, we can already see some bright-hued and active creatures in its capacious bag. A wide board, resting on two thwart, serves for a table, and on this — a few of the more delicate things, that appear at a glance, having been first taken out — the whole contents are poured. The empty dredge is returned to the

deep for another haul, while we set eagerly to work with fingers and eyes on the heap before us.

“What a pleasure it is to examine a tolerably prolific dredge-haul! I am not going to enumerate all the things that we found; it would make a pretty long list. Numbers of rough stones, and of old worm-eaten shells, half a broken bottle, and other strange matters, were there, — every one, however rude, worthy of close examination, because studded with elegant zoöphytes, the tubes of serpulæ and other annelidæ, bright-colored pellucid ascidians, graceful nudibranch molluscæ, the spawn of fishes, and endless other things. Brittle-stars, by scores, were twining their long spiny arms, like lizard’s tails, among the tangled mass, arrayed in the most varied and most gorgeous hues of all varieties of kaleidoscope patterns, (see plate IV.,) * and sand-stars not a few. The latter are much more delicate in constitution than the former, being very difficult to keep alive, and also much more brittle; the former, notwithstanding their English name, I have not found so particularly fragile. Among other members of this wonderful class of animals, we obtained, in the course of our

* Gosse’s “Aquarium.”

day's work, several of that fine but common one, the twelve-rayed sun-star (*Solaster papposa*), a showy creature, dressed in rich scarlet livery, some eight inches in diameter. Two or three of a species usually counted rare also occurred, the bird's foot (*Palmipes membranaceus*), more curious, and equally beautiful. (See plate III.) It resembles a pentagonal piece of thin leather, with the angles a little produced, and regularly pointed. The central part of this disc is scarlet, and a double line of scarlet proceeds from this to each angle, while the whole is margined by a narrow band of the same gorgeous hue. The remainder of the surface is of a pale yellow or cream color, and covered, in the most elegant manner, with tufts of minute spines, arranged in lines which cross each other, lozenge-fashioned, near the middle of the disc, and run parallel to each other, at right angles to the margin, between the points.

“ Not less attractive was another star-fish, the Eyed Cribella (*Cribella oculata*). It consists of five finger-like rays, tapering to a blunt point, and cleft nearly to the centre, the consistence stiffly fleshy, or almost cartilaginous. The hue of both disc and rays, or the superior surface, is a fine rosy purple. (See plate III.)

“All these are very attractive occupants of an aquarium. They are active and restless, though slow in movement, continually crawling about the rocks, and round the sides of the tank, by a gliding motion produced by the attachment and shifting of hundreds of sucker feet, which are protruded at will through minute pores in the calcareous integument. Their showy colors are exhibited to advantage on the dark rocks, around the projections and angles of which they wind their flexible bodies, now and then turning back a ray, from which the pellucid suckers are seen stretching and sprawling ; and as they mount the glass, not only can their hues be admired, but the exquisite structure of their spines, and the mechanism of their suckers, can be studied at leisure.

“Every haul of the dredge brought up several univalve shells, tenanted, not by their original constructors and proprietors, but by their busy intruder, the soldier crab (*Pagurus*). Several species of this curious creature occurred. . . . I shall only just allude to the beautiful cloak anemone (*Adamsia palliata*), and several other species of this charming family. Long-legged spider crabs, of the genera *Stenorynchus*,

Inachus, &c., were abundant, sprawling their slender limbs, like bristles, to an unconscionable distance, tempting us to think that, if we had legs like these, we might cover the ground in a style that would put to shame the old giant-slayer's seven-league boots.

"But, as I have said, time and space would fail me if I were to attempt an enumeration of all the objects of interest that were brought to view in the course of a good day's dredging. Mollusca, both naked and shelled, both univalve and bivalve, and crabs, prawns, and shrimps, worms, sponges, sea-weeds, all presented claims to notice, and all contributed representatives to my stock, in the successive emptyings of the dredge; for we worked pretty nearly all the way home. And when we came to bring on shore the bottles, jars, pans, pails, and tubs, we found them all well tenanted with strange creatures, the greater part of which were despatched on their way to London by the same evening mail train." — *Gosse's Aquarium*, pp. 55, 58, 59, 63.

But if you cannot afford the expense of your own dredge and boat, and the time and trouble necessary to follow the occupation scientifically, yet every trawler and oyster boat will afford you

a tolerable satisfaction. Go on board one of these ; and while the trawl is down, spend a pleasant hour or two in talking with the simple, honest, sturdy fellows who work it, from whom (if you are as fortunate as we have been for many a year past) you may get many a moving story of danger and sorrow, as well as many a shrewd practical maxim, and often, too, a living recognition of God, and the providence of God, which will send you home, perhaps, a wiser and more genial man. And when the trawl is hauled, wait till the fish are counted out, and packed away, and then kneel down and inspect (in a pair of Mackintosh leggings, and your oldest coat) the crawling heap of shells and zoöphytes which remains behind about the decks, and you will find, if a landsman, enough to occupy you for a week to come. Nay, even if it be too calm for trawling, condescend to go out in a coble, and help to haul some honest fellow's deep-sea lines and lobster-pots, and you will find more and stranger things about them than even fish or lobsters : though they, to him who has eyes to see, are strange enough.

We speak from experience ; for it was but the other day that, in the north of Devon, we found

sermons, not indeed in stones, but in a creature reputed among the most worthless of sea-vermin. I had been lounging about all the morning on the little pier, waiting, with the rest of the village, for a trawling breeze which would not come. Two o'clock was past, and still the red mainsails of the skiff's hung motionless, and their images quivered head downwards in the glassy swell,

"As idle as a painted ship
Upon a painted ocean."

It was neap-tide, too, and therefore nothing could be done among the rocks. So, in despair, finding an old coast-guard friend starting for his lobster-pots, I determined to save the old man's arms, by rowing him up the shore ; and then paddled homeward again, under the high green northern wall, five hundred feet of cliff furred to the water's edge with rich oak woods, against whose base the smooth Atlantic swell died whispering, as if curling itself up to sleep at last within that sheltered nook, tired with its weary wanderings. The sun sank lower and lower behind the deer-park point ; the white stair of houses up the glen was wrapt every moment deeper and deeper in hazy smoke and shade, as the light faded :

the evening fires were lighted one by one ; the soft murmur of the water-fall, and the pleasant laugh of children, and the splash of homeward oars, came clearer and clearer to the ear at every stroke : and as we rowed on, arose the recollection of many a brave and wise friend, whose lot was cast in no such western paradise, but rather in the infernos of this sinful earth, toiling even then amid the festering alleys of Bermondsey and Bethnal Green, to palliate death and misery which they had vainly labored to prevent, watching the strides of that very cholera which they had been striving for years to ward off, now re-admitted in spite of all their warnings, by the carelessness, and laziness, and greed of sinful man. And as I thought over the whole hapless question of sanatory reform, proved long since a moral duty to God and man, possible, easy, even pecuniarily profitable, and yet left undone, there seemed a sublime irony, most humbling to man, in some of Nature's processes, and in the silent and unobtrusive perfection with which she has been taught to anticipate, since the foundation of the world, some of the loftiest discoveries of modern science, of which we are too apt to boast as if we had created the method by dis-

covering its possibility. Created it? Alas for the pride of human genius, and the autotheism which would make man the measure of all things, and the centre of the universe! All the invaluable laws and methods of sanatory reform at best are but clumsy imitations of the unseen wonders which every animalecule and leaf have been working since the world's foundation, with this slight difference between them and us, that they fulfil their appointed task, and we do not.

The sickly geranium which spreads its blanched leaves against the cellar panes, and peers up, as if imploringly, to the narrow slip of sunlight at the top of the narrow alley, had it a voice, could tell more truly than ever a doctor in the town, why little Bessy sickened of the scarlatina, and little Johnny of the hooping-cough, till the toddling wee things who used to pet and water it were carried off each and all of them one by one to the churchyard sleep, while the father and mother sat at home, trying to supply by gin that very vital energy which fresh air and pure water, and the balmy breath of woods and heaths, were made by God to give; and how the little geranium did its best, like a heaven-sent angel, to right the wrong which man's ignorance

had begotten, and drank in, day by day, the poisoned atmosphere, and formed it into fair green leaves, and breathed into the children's faces from every pore, whenever they bent over it, the life-giving oxygen for which their dulled blood and festered lungs were craving in vain ; fulfilling God's will itself, though man would not, too careless or too covetous to see, after six thousand years of boasted progress, why God had covered the earth with grass, herb, and tree, a living and life-giving garment of perpetual health and youth.

It is too sad to think long about, lest we become very Heraclituses. Let us take the other side of the matter with Democritus, try to laugh man out of a little of his boastful ignorance and self-satisfied clumsiness, and tell him, that if the House of Commons would but summon one of the little *Paramecia* from any Thames sewer-mouth, to give his evidence before their next Cholera Committee, sanatory blue-books, invaluable as they are, would be superseded for ever and a day, and Sir William Molesworth would no longer have to confess, as he did last year, that he knew of no means of stopping the smells which were driving the

members out of the House, and the judges out of Westminster Hall.

Nay, in the boat at the minute of which I have been speaking, silent and neglected, sat a fellow-passenger, who was a greater adept at removing nuisances than the whole Board of Health put together; and who had done his work, too, with a cheapness unparalleled; for all his good deeds had not as yet cost the state one penny. True, he lived by his business; so do other inspectors of nuisances; but nature, instead of paying Maia Squinado, Esquire, some five hundred pounds sterling per annum for his labor, had contrived, with a sublime simplicity of economy which Mr. Hume might have envied and admired afar off, to make him do his work gratis, by giving him the nuisances as his perquisites, and teaching him how to eat them. Certainly, (without going the length of the Caribs, who uphold Cannibalism because, they say, it makes war cheap, and precludes entirely the need of a commissariat.) this cardinal virtue of cheapness ought to make Squinado an interesting object in the eyes of the present generation, especially as he was at that moment a true sanitary martyr, having, like many of his human fellow-workers, got into a fearful scrape

by meddling with those existing interests, and — “vested rights which are but vested wrongs,” which have proved fatal already to more than one Board of Health. For last night, as he was sitting quietly under a stone in four fathoms water, he became aware (whether by sight, smell, or that mysterious sixth sense, to us unknown, which seems to reside in his delicate feelers) of a palpable nuisance somewhere in the neighborhood; and, like a trusty servant of the public, turned out of his bed instantly, and went in search; till he discovered, hanging among what he judged to be the stems of tangle (*Laminaria*), three or four large pieces of stale thornback, of most evil savor, and highly prejudicial to the purity of the sea, and the health of the neighboring herrings. Happy Squinado! He needed not to discover the limits of his authority, to consult any lengthy Nuisances’ Removal Act, with its clauses, and counter-clauses, and exceptions, and explanations of interpretations, and interpretations of explanations. Nature, who can afford to be arbitrary, because she is perfect, and to give her servants irresponsible powers, because she has trained them to their work, had bestowed on him and on his

forefathers, as general health inspectors, those very summary powers of entrance and removal in the watery realms, for which common sense, public opinion, and private philanthropy are still entreating vainly in the terrestrial realms; so finding a hole, in he went, and began to remove the nuisance, without "waiting twenty-four hours," "laying an information," "serving a notice," or any other vain delay. The evil was there, — and there it should not stay; so, having neither cart nor barrow, he just began putting it into his stomach, and in the mean while set his assistants to work likewise. For suppose not, gentle reader, that Squinado went alone; in his train were more than a hundred thousand as good as he, each in his office, and as cheaply paid; who needed no cumbrous baggage-train of force-pumps, hose, chloride of lime packets, white-wash, pails or brushes, but were every man his own instrument; and, to save expense of transit, just grew on Squinado's back. Do you doubt the assertion? Then lift him up hither, and, putting him gently into that shallow jar of salt-water, look at him through the hand-magnifier, and see how nature is *maxima in minimis*.

There he sits, twiddling his feelers (a substi-

tute, it seems, with crustacea for biting their nails when they are puzzled), and by no means lovely to look on in vulgar eyes ; — about the bigness of a man's fist ; a round-bodied, spindle-shanked, crusty, prickly, dirty fellow, with a villanous squint, too, in those little bony eyes, which never look for a moment both the same way. Never mind : many a man of genius is ungainly enough ; and nature, if you will observe, as if to make up to him for his uncomeliness, has arrayed him as Solomon in all his glory never was arrayed, and so fulfilled one of the few rational proposals of old Fourier, that scavengers, chimney-sweeps, and other workers in disgusting employments, should be rewarded for their self-sacrifice in behalf of the public weal by some peculiar badge of honor, or laurel crown. Not that his crown, like those of the old Greek games, is a mere useless badge ; on the contrary, his robe of state is composed of his fellow-servants. His whole back is covered with a little gray forest of branching hairs, fine as the spider's web, each branchlet carrying its little pearly ringed club, each club its rose-crowned polype, like (to quote Mr. Gosse's comparison) the unexpanded buds of the acacia.*

* *Coryne ramosa*.

On that leg grows, amid another copse of the gray polypes, a delicate straw-colored *Sertularia*, branch on branch of tiny double combs, each tooth of the comb being a tube containing a living flower; on another leg another *Sertularia*, coarser, but still beautiful; and round it again has trained itself, parasitic on the parasite, plant upon plant of glass ivy, bearing crystal bells,* each of which, too, protrudes its living flower; on another leg is a fresh species, like a little heather-bush of whitest ivory,† and every needle leaf a polype cell — let us stop before the imagination grows dizzy with the contemplation of those myriads of beautiful atomies. And what is their use? Each living flower, each polype mouth is feeding fast, sweeping into itself, by the perpetual currents caused by the delicate fringes upon its rays, (so minute these last, that their motion only betrays their presence,) each tiniest atom of decaying matter in the surrounding water, to convert it, by some wondrous alchemy, into fresh cells and buds, and either build up a fresh branch in their thou-and-tenanted tree, or form an egg-cell, from whence, when ripe, may issue, not a fixed zoophyte, but a free swimming animal.

* *Sertularia cristata*.

† *Cristidia churena*.

And in the mean while, among this animal forest, grows a vegetable one of delicatest seaweeds, green and brown and crimson, whose office is, by their everlasting breath, to reoxygenate the impure water, and render it fit once more to be breathed by the higher animals who swim or creep around.

Mystery of mysteries ! Let us jest no more, — Heaven forgive us if we have jested too much on so simple a matter as that poor spider-crab, taken out of the lobster-pots, and left to die at the bottom of the boat, because his more aristocratic cousins of the blue and purple armor will not enter the trap while he is within.

I am not aware whether the surmise, that these tiny zoöphytes help to purify the water by exhaling oxygen gas, has yet been verified. The infusorial animalcules do so, reversing the functions of animal life, and instead of evolving carbonic acid gas, as other animals do, evolve pure oxygen. So, at least, says Liebig, who states that he found a small piece of matchwood, just extinguished, burst out again into a flame on being immersed in the bubbles given out by these living atomies.

I myself should be inclined to doubt that

this is the case with zoöphytes, having found water in which they were growing (unless, of course, sea-weeds were present) to be peculiarly ready to become foul: but it is difficult to say whether this is owing to their deoxygenating the water while alive, like other animals, or to the fact that it is very rare to get a specimen of zoöphyte in which a large number of the polypes have not been killed in the transit home, or at least so far knocked about, that (in the Anthozoa, which are far the most abundant) the polype — or rather living mouth, for it is little more — is thrown off to decay, pending the growth of a fresh one in the same cell.

But all the sea-weeds, in common with other vegetables, perform this function continually, and thus maintain the water in which they grew in a state fit to support animal life.

This fact, first advanced by Priestley and Ingenhousz, and, though doubted by the great Ellis, satisfactorily ascertained by Professor Daubeny, Mr. Ward, Dr. Johnston, and Mr. Warrington, gives an answer to the question, which I hope has ere now arisen in the minds of some of my readers.

How is it possible to see these wonders at

home? Beautiful and instructive as they may be, can they be meant for any but dwellers by the sea-side? Nay more, even to them must not the glories of the water-world be always more momentary than those of the rainbow, a mere *Fata Morgana* which breaks up and vanishes before the eyes? If there were but some method of making a miniature sea-world for a few days; much more of keeping one with us when far inland.

This desideratum has at last been filled up; and science has shown, as usual, that by simply obeying Nature we may conquer her, even so far as to have our miniature sea, of artificial salt-water, filled with living plants and sea-weeds, maintaining each other in perfect health, and each following, as far as is possible in a confined space, its natural habits.

To Dr. Johnston is due, as far as is known, the honor of the first accomplishment of this as of a hundred other zoölogical triumphs. As early as 1842, he proved to himself the vegetable nature of the common pink coralline, which fringes every rock-pool, by keeping it for eight weeks in unchanged salt-water, without any putrefaction ensuing. The ground, of course, on which the proof rested in this case was, that

if the coralline were, as had often been thought, a zoöphyte, the water would become corrupt, and poisonous to the life of the small animals in the same jar; and that its remaining fresh argued that the coralline had reoxygenated it from time to time, and was therefore a vegetable.

In 1850, Mr. Robert Warington communicated to the Chemical Society the result of a year's experiments, "On the Adjustment of the Relations between the Animal and Vegetable Kingdoms, by which the vital Functions of both are permanently maintained." The law which his experiments verified was the same as that on which Mr. Ward, in 1842, founded his invaluable proposal for increasing the purity of the air in large towns, by planting trees, and cultivating flowers in rooms, *that the animal and vegetable respirations might counterbalance each other*; the animal's blood being purified by the oxygen given off by the plants, the plants fed by the carbonic acid breathed out by the animals.

On the same principle, Mr. Warington first kept for many months, in a vase of unchanged water, two small gold-fish and a plant of *Vallisneria spiralis*; and two years afterwards began a similar experiment with sea-water, weeds, and

anemones, which were, at last, as successful as the former ones. Mr. Gosse had, in the mean while, with tolerable success, begun a similar method, unaware of what Mr. Warington had done ; and now the beautiful and curious exhibition of fresh and salt-water tanks, opened last year in the Zoölogical Gardens in London, bids fair to be copied in every similar institution, and we hope in many private houses, throughout the kingdoms.

To this subject Mr. Gosse's last book, "The Aquarium," is principally devoted, though it contains, besides, sketches of coast scenery, in his usual charming style, and descriptions of rare sea-animals, with wise and godly reflections thereon. One great object of interest in the book is the last chapter, which treats fully of the making and stocking these salt-water "Aquaria" ; and the various beautifully colored plates, which are, as it were, sketches from the interior of tanks, are well fitted to excite the desire of all readers to possess such gorgeous living pictures, if as nothing else, still as drawing-room ornaments, flower-gardens which never wither, fairy lakes of perpetual calm which no storm blackens, —

οὐτ' ἐν θέρει, οὐτ' ἐν ὑπώρῃ.

Those who have never seen one of them can never imagine (and neither Mr. Gosse's pencil nor our clumsy words can ever describe to them) the gorgeous coloring and the grace and delicacy of form which these subaqueous landscapes exhibit.

As for coloring, — the only bit of color which I can remember even faintly resembling them, (for though Correggio's *Magdalene* may rival them in greens and blues, yet even he has no such crimsons and purples,) is the *Adoration of the Shepherds*, by that "prince of colorists," Palma Vecchio, which hangs on the left-hand side of Lord Ellesmere's great gallery. But as for the forms, — where shall we see their like? Where, amid miniature forests as fantastic as those of the tropics, animals whose shapes outvie the wildest dreams of the old German ghost-painters which cover the walls of the galleries of Brussels or Antwerp? And yet the uncouthest has some quaint beauty of its own, while most — the star-fishes and anemones, for example — are nothing but beauty. The brilliant plates in Mr. Gosse's "*Aquarium*" give, after all, but a meagre picture of the reality, as it may be seen either in his study, or in the tank-house at the

Zoölogical Gardens; and as it may be seen also by any one who will follow carefully the directions given at the end of his book, stock a glass vase with such common things as he may find in an hour's search at low tide, and so have an opportunity of seeing how truly Mr. Gosse says, in his valuable preface, that —

“The habits” (and he might well have added, the marvellous beauty) “of animals will never be thoroughly known till they are observed in detail. Nor is it sufficient to mark them with attention now and then; they must be closely watched, their various actions carefully noted, their behavior under different circumstances, and especially those movements which seem to us mere vagaries, undirected by any suggestible motive or cause, well examined. A rich fruit of result, often new and curious and unexpected, will, I am sure, reward any one who studies living animals in this way. The most interesting parts, by far, of published Natural History are those minute, but graphic particulars, which have been gathered up by an attentive watching of individual animals.”

Mr. Gosse's own books, certainly, give proof

enough of this. We need only direct the reader to his exquisitely humorous account of the ways and works of a captive soldier-crab,* to show them how much there is to be seen, and how full nature is also of that ludicrous element of which we spoke above. And, indeed, it is in this form of Natural History: not in mere classification, and the finding out of names, and quarrellings as to the first discovery of that beetle or this butter-cup,—too common, alas! among mere closet-collectors,—“endless genealogies,” to apply St. Paul’s words by no means irreverently or fancifully, “which do but gender strife”;—not in these pedantries is that moral training to be found, for which we have been lauding the study of Natural History: but in healthful walks and voyages out of doors, and in careful and patient watching of the living animals and plants at home, with an observation sharpened by practice, and a temper calmed by the continual practice of the naturalist’s first virtues,—patience and perseverance.

Practical directions for forming an “Aquarium” may be found in Mr. Gosse’s book bearing that name, at pp. 101, 255, et seq.; and

* Aquarium, p. 163.

those who wish to carry out the notion thoroughly cannot do better than buy his book, and take their choice of the many different forms of vase, with rockwork, fountains, and other pretty devices which he describes.

But the many, even if they have Mr. Gosse's book, will be rather inclined to begin with a small attempt; especially as they are probably half sceptical of the possibility of keeping sea-animals inland without changing the water. A few simple directions, therefore, will not come amiss here. They shall be such as any one can put into practice, who goes down to stay in a lodging-house at the most cockney of watering-places.

Buy at any glass-shop a cylindrical glass jar, some six inches in diameter and ten high, which will cost you from three to four shillings; wash it clean, and fill it with clean salt-water, dipped out of any pool among the rocks, only looking first to see that there is no dead fish or other evil matter in the said pool, and that no stream from the land runs into it. If you choose to take the trouble to dip up the water over a boat's side, so much the better.

So much for your vase; now to stock it.

Go down at low spring-tide to the nearest ledge of rocks, and with a hammer and chisel chip off a few pieces of stone covered with growing sea-weed. Avoid the common and coarser kinds (*fuci*) which cover the surface of rocks; for they give out under water a slime which will foul your tank; but choose the more delicate species which fringe the edges of every pool at low water mark; the pink coralline, the dark purple ragged dulse (*Rhodymenia*), the Carrageen moss (*Chondrus*), and, above all, the commonest of all, the delicate green *Ulva*, which you will see growing everywhere in wrinkled fan-shaped sheets, as thin as the finest silver-paper. The smallest bits of stone are sufficient, provided the sea-weeds have hold of them; for they have no real roots, but adhere by a small disc, deriving no nourishment from the rock, but only from the water. Take care, meanwhile, that there be as little as possible on the stone beside the weed itself. Especially scrape off any small sponges, and see that no worms have made their twining tubes of sand among the weed-stems; if they have, drag them out; for they will surely die, and as surely spoil all by sulphuretted hydrogen, blackness, and evil smells.

Put your weeds into your tank, and settle them at the bottom ; which last some say should be covered with a layer of pebbles : but let the beginner leave it as bare as possible ; for the pebbles only tempt cross-grained annelids to crawl under them, die, and spoil all by decaying : whereas if the bottom of the vase is bare, you can see a sickly or dead inhabitant at once, and take him out (which you must do) instantly. Let your weeds stand quietly in the vase a day or two before you put in any live animals ; and even then, do not put any in if the water does not appear perfectly clear : but lift out the weeds, and renew the water ere you replace them.

Now for the live stock. In the crannies of every rock you will find sea-anemones (*Actinæ*) ; and a dozen of these only will be enough to convert your little vase into the most brilliant of living flower-gardens. There they hang upon the under side of the ledges, apparently mere rounded lumps of jelly : one is of a dark purple dotted with green ; another of a rich chocolate ; another of a delicate olive ; another sienna-yellow ; another all but white. Take them from their rock ; you can do it easily by slipping under them your finger-nail, or the edge of a

pewter spoon. Take care to tear the sucking base as little as possible (though a small rent they will darn for themselves in a few days, easily enough), and drop them into a basket of wet sea-weed; when you get home, turn them into a dish full of water and leave them for the night, and go to look at them to-morrow. What a change! The dull lumps of jelly have taken root and flowered during the night, and your dish is filled from side to side with a bouquet of chrysanthemums; each has expanded into a hundred-petalled flower, crimson, pink, purple, or orange; touch one, and it shrinks together like a sensitive plant, displaying at the root of the petals a ring of brilliant turquoise beads. That is the commonest of all the *Actiniæ* (*Mesembryanthemum*); you may have him when and where you will: but if you will search those rocks somewhat closer, you will find even more gorgeous species than him. See in that pool some dozen noble ones, in full bloom, and quite six inches across, some of them. If their cousins whom we found just now were like chrysanthemums, these are like quilled dahlias. Their arms are stouter and shorter in proportion than those of the last species, but

their color is equally brilliant. One is a brilliant blood-red ; another a delicate sea-blue, striped with pink ; but most have the disc and the innumerable arms striped and ringed with various shades of gray and brown. Shall we get them ? By all means, if we can. Touch one. Where is he now ? Gone ? Vanished into air, or into stone ? Not quite. You see that knot of sand and broken shell lying on the rock, where your dahlia was one moment ago. Touch it, and you will find it leathery and elastic. That is all which remains of the live dahlia. Never mind ; get your finger into the crack under him, work him gently but firmly out, and take him home, and he will be as happy and as gorgeous as ever to-morrow.

Let your Actinæ stand for a day or two in the dish, and then, picking out the liveliest and handsomest, detach them once more from their hold, drop them into your vase, right them with a bit of stick, so that the sucking base is downwards, and leave them to themselves thenceforth.

These two species (*Mesembryanthemum* and *Crassicornis*) are quite beautiful enough to give a beginner amusement : but there are two others

which are not uncommon, and of such exceeding loveliness, that it is worth while to take a little trouble to get them. The one is *Bellis*, the sea-daisy, of which there is an excellent description and plates in Mr. Gosse's "Rambles in Devon," pp. 24-32.

It is common at Ilfracombe, and at Torquay; and indeed everywhere where there are cracks and small holes in limestone or slate rock. In these holes it fixes its base, and expands its delicate brown-gray star-like flowers on the surface: but it must be chipped out with hammer and chisel, at the expense of much dirt and patience; for the moment it is touched it contracts deep into the rock, and all that is left of the daisy flower, some two or three inches across, is a blue knot of half the size of a marble. But it will expand again, after a day or two of captivity, and well repay all the trouble which it has cost.

The other is *Dianthus*; which you may find adhering to fresh oysters in any dredger or trawler's skiff, a lengthened mass of olive, pale rose, or snow-white jelly. The rose and the white are the more beautiful; the very maiden queens of all the beautiful tribe. If you find

one, clear the shell on which it grows of everything else (you may leave the oyster inside if you will), and watch it expand under water into a furbelowed flower, furred with innumerable delicate tentacula ;* and in the centre, a mouth of the most brilliant orange ; altogether one of the loveliest gems, in the opinion of him who writes, with which it has pleased God to bedeck his lower world.

But you will want more than these anemones, both for your own amusement and for the health of your tank. Microscopic animals will breed, and will also die ; and you need for them some such scavenger as our poor friend Squinado, to whom you were introduced a few pages back. Turn, then, a few stones which lie piled on each other at extreme low-water mark, and five minutes' search will give you the very animal you want,—a little crab, of a dingy russet above, and on the underside like smooth porcelain. His back is quite flat, and so are his large angular fringed claws, which, when he folds them up, lie in the same plane with his shell, and fit neatly into its edges. Compact little rogue that he is, made especially for sideling in and out of cracks

* See Gosse's Aquarium, Plate V. p. 192.

and crannies, he carries with him such an apparatus of combs and brushes as Isidor or Floris never dreamed of; with which he sweeps out of the sea-water at every moment shoals of minute animalcules, and sucks them into his tiny mouth. Mr. Gosse will tell you more of this marvel, in his *Aquarium*, p. 48.

Next, your sea-weeds, if they thrive as they ought to do, will sow their minute spores in millions around them; and these, as they vegetate, will form a green film on the inside of the glass, spoiling your prospect; you may rub it off for yourself, if you will, with a rag fastened to a stick, but if you wish at once to save yourself trouble, and to see how all emergencies in nature are provided for, you will set three or four live shells to do it for you, and to keep your sub-aqueous lawn close mown.

That last word is no figure of speech. Look among the beds of sea-weed for a few of the bright yellow or green sea-snails (*Nerita*), or Conical Tops (*Trochus*), especially that beautiful pink one spotted with brown (*Ziziphinus*), which you are sure to find about shaded rock-ledges at dead low tide, and put them into your aquarium. For the present, they will only

nibble the green *ulvæ*, but when the film of young weed begins to form, you will see it mown off every morning as fast as it grows, in little semicircular sweeps, just as if a fairy's scythe had been at work during the night.

And a scythe has been at work ; none other than the tongue of the little shell-fish ; a description of its extraordinary mechanism (too long to quote here, but which is well worth reading) may be found in Gosse's *Aquarium*.*

A prawn or two, and a few minute star-fish, will make your aquarium complete ; though you may add to it endlessly, as one glance at the salt-water tanks of the Zoölogical Gardens and the strange and beautiful forms which they contain will prove to you sufficiently.

You have two more enemies to guard against ; dust and heat. If the surface of the water becomes clogged with dust, the communication between it and the life-giving oxygen of the air is cut off ; and then your animals are liable to die, for the very same reason that fish die in a pond which is long frozen over, unless a hole be broken in the ice to admit the air. You must guard against this by occasional stirring of the sur-

* P. 34.

face, (it should be done once a day, if possible,) and by keeping on a cover. A piece of muslin tied over will do ; but a better defence is a plate of glass, raised on wire some half inch above the edge, so as to admit the air. I am not sure that a sheet of brown paper laid over the vase is not the best of all, because that by its shade also guards against the next evil, which is heat. Against that you must guard by putting a curtain of muslin or oiled paper between the vase and the sun, if it be very fierce, or simply (for simple expedients are best) by laying a handkerchief over it till the heat is past. But if you leave your vase in a sunny window long enough to let the water get tepid, all is over with your pets. Half an hour's boiling may frustrate the care of weeks. And yet, on the other hand, light you must have, and you can hardly have too much. Some animals certainly prefer shade, and hide in the darkest crannies ; and for them, if your aquarium is large enough, you must provide shade, by arranging the bits of stone into piles and caverns. But without light, your sea-weeds will neither thrive, nor keep the water sweet. With plenty of light you will see, to quote Mr. Gosse once

more,* “thousands of tiny globules forming on every plant, and even all over the stones, where the infant vegetation is beginning to grow ; and these globules presently rise in rapid succession to the surface all over the vessel, and this process goes on uninterruptedly as long as the rays of the sun are uninterrupted.

“Now these globules consist of *pure oxygen*, given out by the plants under the stimulus of light ; and to this oxygen the animals in the tank owe their life. The difference between the profusion of oxygen-bubbles produced on a sunny day, and the paucity of those seen on a dark, cloudy day, or in a northern aspect, is very marked.” Choose, therefore, a south or east window, but draw down the blind, or throw a handkerchief over all if the heat become fierce. The water should always feel cold to your hand, let the temperature outside be what it may.

Next, you must make up for evaporation by *fresh* water. A very little will suffice, as often as in summer you find the water in your vase sink below its original level, and prevent the water from getting too salt. For the salts, remember, do not evaporate with the water, and if you left

* P. 259.

the vase in the sun for a few weeks, it would become a mere brine-pan.

But how will you move your treasures up to town?

The simplest plan which I have found successful is an earthen jar. You may buy them with a cover which screws on with two iron clasps. If you do not find such, a piece of oilskin tied over the mouth is enough. But do not fill the jar full of water; leave about a quarter of the contents in empty air, which the water may absorb, and so keep itself fresh. And any pieces of stone, or oysters, which you send up, hang by a string from the mouth, that they may not hurt tender animals by rolling about the bottom. With these simple precautions, anything which you are likely to find will well endure forty-eight hours of travel.

What if the water fails after all?

Then Mr. Gosse's artificial sea-water will form a perfect substitute. You may buy the requisite salts (for there are more salts than "salt" in sea-water) from any chemist to whom Mr. Gosse has intrusted his discovery, and, according to his directions, make sea-water for yourself.*

* Mr. W. Bolton, Chemist, of 146 Holborn Bars, London, will furnish the materials.

One more hint before we part. If, after all, you are not going down to the sea-side this year, and have no opportunities of testing the “wonders of the shore,” you may still study Natural History in your own drawing-room, by looking a little into “the wonders of the pond.”

I am not jesting ; a fresh-water aquarium, though by no means as beautiful as a salt-water one, is even more easily established. A glass jar, floored with two or three inches of pond-mud (which should be covered with fine gravel to prevent the mud washing up) ; a specimen of each of two water-plants which you may buy now at any good shop in Covent Garden, *Vallisneria spiralis* (which is said to give to the canvas-backed duck of America its peculiar richness of flavor), and *Anacharis alsinastrum*, that magical weed which, lately introduced from Canada among timber, has multiplied, self-sown, to so prodigious an extent, that it bids fair in a few years to choke the navigation not only of our canals and fen-rivers, but of the Thames itself :—these (in themselves, from the transparency of their circulation, interesting microscopic objects) for oxygen-breeding vegetables ; and for animals, the pickings of

any pond. A minnow or two ; an eft ; some of those caddis-baits (walking tubes of straw, sticks, and shells) and water-crickets, which you may find under any stone ; a few of the delicate pond-snails (unless they devour your *Vallisneria* too rapidly) ; water-beetles, of activity inconceivable ; and that wondrous bug, the *Notonecta*, who lies on his back all day, rowing about his boat-shaped body, with one long pair of oars, in search of animalcules, and, the moment the lights are out, turns head over heels, rights himself, and, opening a pair of handsome wings, starts to fly about the dark room in company with his friend the water-beetle, and (I suspect) catch flies, and then slips back demurely into the water with the first streak of dawn ; — these animals, their habits, their miraculous transformations, as the caddis-baits appear at the top of the water as alder-flies and sedge-flies (*Phryganeæ*) and the water-crickets as duns and drakes (*Ephemereæ*) of the most delicate beauty, might give many an hour's quiet amusement to an invalid, laid on a sofa, or imprisoned in a sick-room, and debarred from reading, unless by some such means, any page of that great green book outside, whose pen is the finger of God, whose covers are the

fire kingdoms and the star kingdoms, and its leaves the heather-bells, and the polypes of the sea, and the gnats above the summer stream.

And, now, how can this desultory little treatise end more usefully than in recommending a few books on Natural History, fit for the use of young people? Not that this list will contain all the best; but simply the best of which the writer knows; let, therefore, none feel aggrieved, if, as it may chance, opening these pages, they find their books omitted.

First and foremost, certainly, come Mr. Gosse's books. There is a playful and genial spirit in them, a brilliant power of word-painting, combined with deep and earnest religious feeling, which makes them as morally valuable as they are intellectually interesting. Since White's "History of Selborne," few or no writers on Natural History, save Mr. Gosse and poor Mr. E. Forbes, have had the power of bringing out the human side of science, and giving to seemingly dry disquisitions and animals of the lowest type, by little touches of pathos and humor, that living and personal interest, to bestow which is generally the special function of the poet: not that Waterton and Jesse are not excellent in

this respect, and authors who should be in every boy's library: but they are rather anecdotists than systematic or scientific inquirers; while Mr. Gosse, in his "Naturalist on the Shores of Devon," his "Tour in Jamaica," and his "Canadian Naturalist," has done for those three places what White did for Selborne, with all the improved appliances of a science which has widened and deepened tenfold since White's time.

Miss Anne Pratt's "Things of the Sea-coast" is excellent; and still better is Professor Harvey's "Sea-side Book," of which it is impossible to speak too highly; and most pleasant it is to see a man of genius and learning thus gathering the bloom of his varied knowledge, to put it into a form equally suited to a child and to a *savant*. Seldom, perhaps, has there been a little book in which so vast a quantity of facts has been compressed into so small a space, and yet told so gracefully, simply, without a taint of pedantry or cumbrousness,—an excellence which is the sure and only mark of a perfect mastery of the subject.

Two little "Popular" Histories, one of British Zoöphytes, the other of British Sea-weeds, by

Dr. Landsborough (lately dead of cholera, at Saltcoats, the scene of his energetic and pious ministry), are very excellent ; and are furnished, too, with well-drawn and colored plates, for the comfort of those to whom a scientific nomenclature (as liable as any other human thing to be faulty and obscure) conveys but a vague conception of the objects. These may serve well for the beginner, as introductions to Professor Harvey's large work on the British Algæ, and to the new edition of Professor Johnston's invaluable "British Zoöphytes."

For general Zoölogy the best books for beginners are, perhaps, as an introduction to comparative anatomy, Professor Rymer Jones's "Animal Kingdom" ; and for systematic Zoölogy, Mr. Gosse's four little books, on Mammals, Birds, Reptiles, and Fishes, published, with many plates, by the Christian Knowledge Society, at a marvellously cheap rate. For microscopic animalcules, Miss Agnes Catlow's "Drops of Water" will teach the young more than they will ever remember, and serve as a good introduction to those teeming abysses of the unseen world, which must be afterwards traversed under the guidance of Hassall and Ehrenberg.

For Ornithology, there is no book, after all, like dear old Bewick, *passé* though he may be in a scientific point of view. There is a good little British Ornithology, too, published in Sir W. Jardine's "Naturalist's Library," and another by Mr. Gosse. And Mr. Knox's "Ornithological Rambles in Sussex," with Mr. St. John's "Highland Sports" and "Tour in Sutherlandshire," are the monographs of naturalists, gentlemen, and sportsmen, which remind one at every page (and what higher praise can one give?) of White's "History of Selborne." These last, with Mr. Gosse's "Canadian Naturalist," and his little book, "The Ocean," not forgetting Darwin's delightful "Voyage of the Beagle and Adventure," ought to be in the hands of every lad who is likely to travel to our colonies.

For general Geology, Professor Anstey's Introduction is excellent; while, as a specimen of the way in which a single district may be thoroughly worked out, and the universal method of induction learnt from a narrow field of objects, what book can, or perhaps ever will, compare with Mr. Hugh Miller's "Old Red Sandstone"?

For this last reason, I especially recommend to the young the Rev. C. A. Johns's "Week at the Lizard," as teaching a young person how much there is to be seen and known within a few square miles of the British Isles. But, indeed, all Mr. Johns's books are good, (as they are bound to be, considering his most accurate and varied knowledge,) especially his "Flowers of the Field," the best cheap introduction to systematic botany which has as yet appeared. Trained, and all but self-trained, like Mr. Hugh Miller, in a remote and narrow field of observation, Mr. Johns has developed himself into one of our most acute and persevering botanists, and has added many a new treasure to the Flora of these isles ; and one person, at least, owes him a deep debt of gratitude for first lessons in scientific accuracy and patience, — lessons taught, not dully and dryly at the book and desk, but livingly and genially, in adventurous rambles over the bleak cliffs and ferny woods of the wild Atlantic shore, —

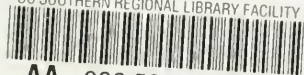
" Where the old fable of the guarded mount
Looks toward Namaneos and Bayona's hold."

And so I end this little book, hoping, even praying, that it may encourage a few more

laborers to go forth into a vineyard, which those who have toiled in it know to be full of ever-fresh health, and wonder, and simple joy, and the presence and the glory of Him whose name is Love.

THE END.

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